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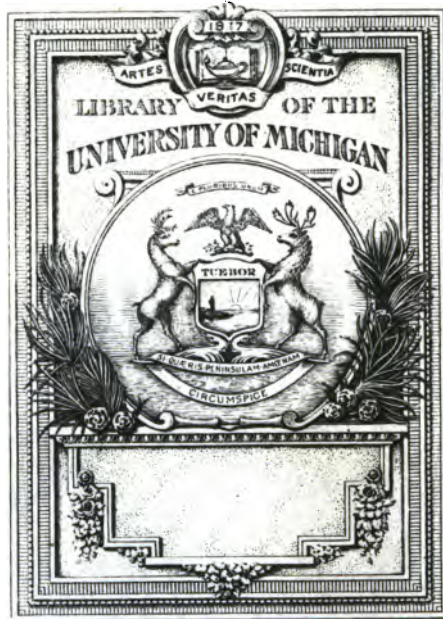
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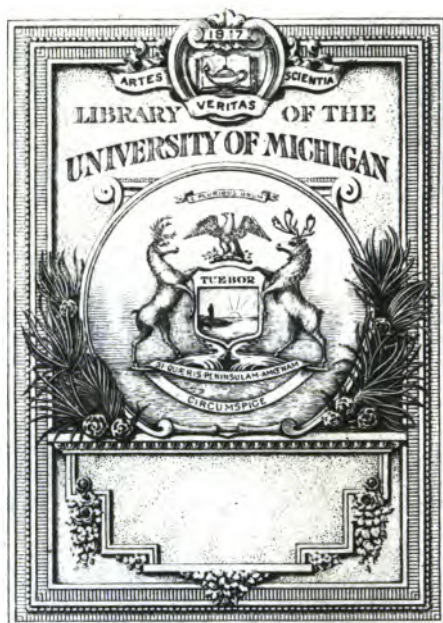
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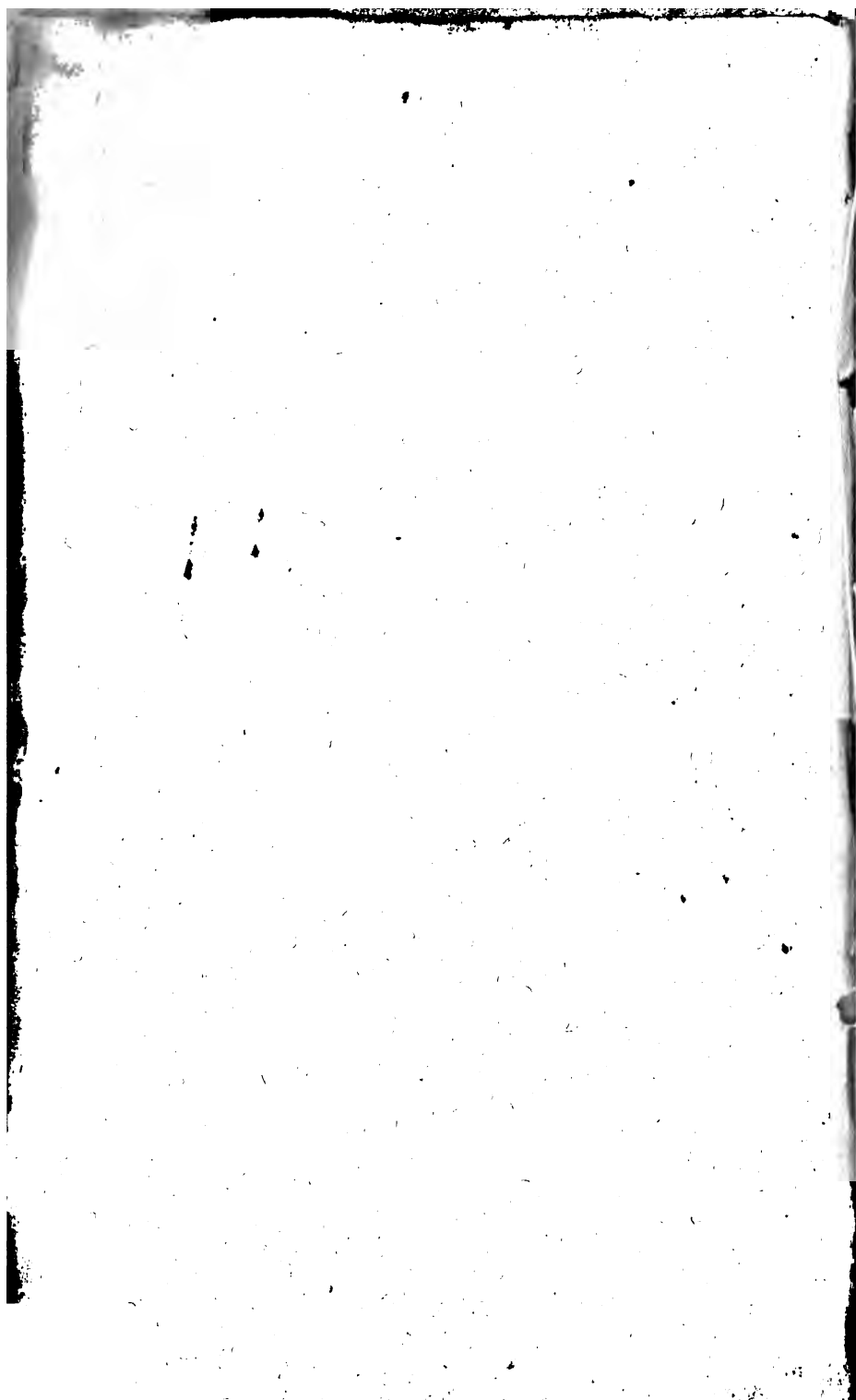
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George Carvers
Arithmetic Book
May the 24 1876



A NEW
AND
PLAIN SYSTEM OF
ARITHMETIC,

CONTAINING
THE SEVERAL RULES
OF THAT USEFUL SCIENCE,
Concisely Defined, and Greatly Simplified.

THE WHOLE,
PARTICULARLY ADAPTED
TO THE EASY AND REGULAR INSTRUCTION OF YOUTH,
AND TO THE
TRADE AND COMMERCE
OF THE
UNITED STATES.

By ELIJAH H. HENDRICK.

RICHMOND:
PRINTED BY LYNCH & DAVIS,

1810.

District of Virginia, to wit :

SEAL.
BE IT REMEMBERED, That on the first day of May, in the thirty-fourth year of the Independence of the United States of America, *Elijah H. Hendrick*, of the said district, hath deposited in this office, the title of a book, the right whereof he claims as author, in the words following, to wit :

"A New and Plain System of Arithmetic, containing the several rules of that useful science, concisely defined, and greatly simplified; the whole particularly adapted to the easy and regular instruction of youth, and to the trade and commerce of the United States by *Elijah H. Hendrick*."

In conformity to the act of the congress of the United States, entitled, "An Act for the encouragement of learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the times therein mentioned;" and also to An Act, entitled, "An Act, supplementary to an Act, entitled, An Act for the encouragement of learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the times therein mentioned, and extending the benefits thereof to the arts of designing, engraving and etching historical and other prints."

William Marshall,

Clerk of the District of Virginia.

Hist. & Science.
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PREFACE.

THE Compiler of this volume is not fond of elaborate prefaces ; he claims no distinguished merit ; and, therefore, briefly states, that he has had recourse to various authors on the subject, to whom he acknowledges himself indebted for a considerable portion of this system : having taken the liberty of extracting such parts as were applicable to his purpose, and of abridging or enlarging as he thought necessary.

To unite as much as possible their several advantages, with a number of recent calculations made in money of the United States ; to express the different rules with precision in plain language ; to point out a number of short and easy methods of contraption ; to elucidate every rule, by performing at length, from one to three examples ; to give a competent number of suitable questions ; and particularly to adapt the work to the easy and regular instruction of youth, and to the trade and commerce of the United States, has been his great aim.

Any friendly communication which may tend to improve this edition will be thankfully received by the author, who is conscious of benevolent designs, whatever may be the success of his undertakings.

Buckingham County, Virginia, May 1, 1810.

Explanation of Characters.

SIGNS

SIGNIFICATIONS.

=	equal, as, 100 cts. = 1 dollar.
+	more. as, $6 + 4 = 10$
-	less, 2, $10 - 4 = 6$
×	into, with, or multiplied by, as, $6 \times 2 = 12$
÷	by, (i. e. divided by) as, $6 \div 2 = 3$, or, $2 \overline{)6} 3$
:: ::	proportionality, as, $2 : 4 :: 6 : 12$
√ or ² √	Square Root, as, ² √ 64 = 8
³ √	Cube Root, as, ³ √ 64 = 4
⁴ √	Fourth Root, as, ⁴ √ 64 = 2
—	A Vinculum, denoting the several quantities over which it is drawn, to be considered jointly as a simple quantity.

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ARITHMETIC.

ARITHMETIC is the art of computing by numbers—
Its whole superstructure is founded on the first five rules :
namely, Numeration, Addition; Subtraction, Multiplication
and Division.

Numeration.

NUMERATION teaches to read or write any number, there
are ten figures called digits, viz:—1, 2, 3, 4, 5, 6, 7, 8, 9
and 0, which of itself signifies nothing more than the absence
of other figures, when alone of no value.

Figures valued from the right hand to the left, increase in
a tenfold proportion, and are divided into periods and half
periods. The period contains six, and the half period three
figures, which are marked thus—Period (.) half period (,)—
Observe the following tables.

	I	Units	I
I 2	Tens	I 0	
I 2 3	Hundreds	I 0 0	
I, 2 3 4	Thousands	I, 0 0 0	
I 2, 3 4 5	X Thousands	I 0, 0 0 0	
I 2 3, 4 5 6	C Thousands	I 0 0, 0 0 0	
I. 2 3 4, 5 6 7	Millions	I. 0 0 0, 0 0 0	
I 2. 3 4 5, 6 7 8	X Millions	I 0. 0 0 0, 0 0 0	
I 2 3. 4 5 6, 7 8 9	C Millions.	I 0 0. 0 0 0, 0 0 0	

Although the foregoing Tables may suffice for common
use, yet it may be necessary to shew that the power of num-
bers may be extended much further than nine numerical
figures or characters. In order to do this, extend your peri-
od of millions to six figures, then add Billions, Trillions,
Quatrillions, &c. in the same manner, which will appear
more plain from a view of the following table.

NUMERATION.

Units	6
Tens	65
Hundreds	672
Thousands	5, 678
X Thousands	56, 789
C Thousands	564, 876
Millions	4. 864, 872
X Millions	11. 346, 078
C Millions	348. 648, 648
Thousands of Millions	4, 863. 818, 161
X Thousand of Mil.	12, 346. 567, 890
C Thousands of Mil.	264, 864, 521, 213
Billions	1. 348, 648. 348, 645
X Billions	48. 648, 764. 265, 212
C Billions	548. 684, 253. 486, 555
Thousand of Billions	4, 144. 684, 134. 145, 645
X Thousands of Bil.	14, 865. 864, 586. 418, 618
C Thousands of Bil.	648, 618. 186, 458. 121, 642
Trillions	1. 245, 678. 942, 164. 186, 134
X Trillions	21. 458, 645. 186, 458. 642, 161
C Trillions	748. 654, 164. 518, 648. 512, 121
Thousands of Tril.	4, 864. 186, 518. 237, 645. 123, 224
X Thousands of Tril.	74, 846. 586, 486. 416, 182. 186, 671
C Thousands of Tril.	864, 581. 237, 865. 848, 612. 347, 561

Examples in Numeration.

Set down seventeen in figures,

Forty-five,

One hundred and two,

Seven hundred and eleven,

One thousand and ten,

Thirty-six thousand one hundred,

Eight hundred thousand,

Six hundred and forty-five thousand,

One million and ten,

Three million and seventy-seven.

Seven million seven thousand and six,

Ninety-nine million and seventy thousand.

It is indispensable that the pupil should practise in examples of the above nature, until he can set them down at pleasure.

SIMPLE ADDITION.

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Simple Addition.

SIMPLE ADDITION shews the method of finding the sum total of several numbers bearing the same denomination.

The different sums being set down, units under units, tens under tens, &c. &c. begin with your right hand figure in the units line, add that line, consider how many tens are contained in it, and how many over; set down what is over, and carry one for every ten to the next line, and so with each of the rest, and you will have the sum total.

PROOF. Cut off the top line, add the sum as before, setting down the product in the same manner under the former line, then add this sum and the top line together; when the work is right, they will produce the first sum total.

Examples.

	£.	lbs.	cwt.	Miles
	12345678	167890	767676	343434
	72567890	737373	676767	464748
	14685341	373737	304067	827160
	74747474	644765	168905	161718
	47474747	473060	321046	360606
Sum total.	221821130	5		
	209475452			
Proof.	221821130			

1234567	3676432	164763210
8765043	167674	16867432
2456789	74748	1567809
1247678	1316	143654
3650654	1012	13067
1236052	133	1234
9161718	14	113
8617132	1	10
1618225	1674543	1
6767676	160764	163

Practical questions in Simple Addition.

1. Add 1676, 1384, 1260, 262, and three thousand six hundred and thirty-six together.

Answer—8218.

2. A man was born in the year 1794, when will he be 75 years of age?

Answer—in 1869.

3. From Richmond to Orsborne's it is distant 15 miles, from thence to Petersburg 10, how far distant is Petersburg from Richmond?

Answer—25 miles.

4. Your horse is worth two hundred dollars, your chaise 450, and the harness 60 dollars, how much are they all worth?

Answer—710 dols.

5. If you have one hundred and 40 cows, 28 oxen, and 72 calves, how many cattle have you?

Answer—240.

6. Suppose you have two fields in corn, one has 45000 hills, and the other 36118; what number have you in all?

Answer—81118.

7. I have 6 hhds of tobacco weighing as follows, viz :—No. 1, 1676, No. 2, 1501, No. 3, 1284, No. 4, 1167, No. 5, 1763 and No. 6, 900 lbs. what do they all weigh?

Answer—8291 lbs.

8. If you have land valued at 7500 dollars, property in town valued at 1205 dols. and 1800 dols. in the Virginia Bank, what is your estate worth?

Answer—10505 dols.

9. In the city of Moscow, in Russia, is a bell weighing 443,772 pounds, in Pekin, in China, another that weighs 120,000 pounds; and another in the same country, at the city of Nankin that weighs 50,000 pounds; how much do they all weigh?

Answer—613772 lbs.

10. If a merchant have owing to him on bond, 1671*l.* in book accounts 3467*l.* in bills and notes 40*l.* and have in cash 367*l.* what is the amount?

Answer—5545*l.*

11. If you have 1676 eagles in one purse, 167 in another, 17 in a third, and seventeen hundred and seventy-nine in a fourth; what number is there in them all?

Answer—3639.

12. If from the creation of the world to the flood be 1650 years, from that to the calling of Abraham 427, from that to the building of the temple 909, thence to the founding of Rome 266, from that to the birth of our Saviour (Christ) 752, and since to the present year 1810; How many years since the creation?

Answer—5814.

Simple Subtraction.

SIMPLE SUBTRACTION teaches to find the difference between any two numbers of the same denomination; the greater number is called the Minuend, the lesser the Subtrahend, the difference the remainder.

RULE. Place Units under Units, Tens under Tens, &c. &c. If the under figure be greater than the upper, borrow ten, which add to the upper, and for every ten so borrowed, carry one to the next figure, thus proceeding until the whole be finished.

PROOF. Add the remainder and subtrahend together, their sum will be equal to the Minuend, when the work is right.

Examples.

Minuend.	127675321	1673267	16436067	36756401
Subtrahend.	96586211	674370	7103478	7678909
Remainder.	31089110			
Proof.	127675321			

Min.	7674005	1364406	99906743	1284674	5006000
Subt.	1785444	911678	1119999	906075	340999
Remr.					
Proof.					

Practical questions in Simple Subtraction.

1. What sum taken from 200 dollars will leave seventy-five dollars ? *Answer—125.*

2. A. & B. purchase a Hhd. of Sugar, containing 1100 lbs. of which B. had 600 weight; how much had A. left ? *Answer—500 lbs.*

3. C. owes D. four hundred and ten thousand dollars, and pays him eight thousand five hundred dollars; what balance is still due D. *Answer—401500.*

4. General George Washington was born in 1732, and departed this life in 1799; what was his age ? *Answer—67.*

5. The Mariner's compass was invented in 1302, and America was discovered in 1492; how many years between these discoveries?
Answer—190.

6. You are informed that the great bell at Moscow weighs 443,772 lbs. and that at Pekin one hundred and twenty thousand pounds; what difference are there in their weights?
Answer—323,772.

7. Your parent presents you with twenty dollars, pocket money, of which you spend five, loose three, and give two dollars to the poor; how many have you remaining?
Answer—10.

8. The population of the United States is estimated at about 5405000. That of the Chinese government at three hundred and thirty-three million; what difference in the population of the two countries, and which has the greatest number?
Answer—China by 327595000.

9. If you have 1500 guineas, and pay 110 to your father's merchant; what number will you have left?
Answer—1390.

Simple Multiplication.

Simple Multiplication is a compendious method of performing addition; and consists of the following terms:

The Multiplicand, or number to be multiplied.

The Multiplier, or number by which you multiply.

The Product, or number produced by the operation.

Before any particular rules are given, it is essential that the pupil should commit the following table to memory,

SIMPLE MULTIPLICATION.

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Multiplication Table.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

RULE 1. When the multiplier does not exceed 12, perform the operation as follows: Set down the multiplier under the units line of the multiplicand and multiply the unit figure by the multiplier, consider how many tens it produces, and how many over, set down what is over, and carry one for every ten to the next figure when multiplied, and so on till you arrive at the left hand figure, which, when you have multiplied, set down the whole product, and you have the answer required.

PROOF. Divide the product or answer by the Multiplier, it will produce the Multiplicand when the work is right.

Examples.

Multiplicand.	4789621	12345602	12374601
Multiplier	2	3	4
Product.	2) 9579242		
Proof.	4789621		

Multiplicand.	1674309	78689463	45696464
Multiplier.	5	6	7
Multiplicand.	48648647	96564864	13507028
Multiplier.	8	9	10

RULE 2. When confining of a number that can be multiplied into itself, make the multiplier separate in two smaller ones, or numbers, viz :—If the multiplier be 15, multiply the multiplicand by 5, and that product by 3, which gives the product of 15, &c.

PROOF. Divide by the same numbers, and in the same order in which you multiply.

Examples.

Multiply	56783201	by 15	48696786	by 72
	5		6	
	283916005		292180716	
	3		12	
3)851748615	Product.	12)3506168592		
5)283916005		6)292180716		
56783201	Proof.	48696786		

3. Multiply	123456789	by 36.	Answer—4444444404.
4.	4867481	by 108.	525687948
5.	1607065	by 144.	231417360

RULE 3. When confining of numbers which cannot be multiplied into itself; multiply by the figures in your multiplier separately, making as many products as there are figures in the multiplier, omitting cyphers, and place the first figure of each product exactly under the multiplier; add their products together, and their sum will be the answer, or number sought.

SIMPLE MULTIPLICATION.

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PROOF. Reject the nines in the multiplicand, multiplier and product, and set the excess of each against their respective terms; then multiply the excess in the multiplicand, by the excess in the multiplier, and cast out the nines; when the excess or surplus is the same as that of the product, the work is right.

NOTE. If cyphers be in the multiplicand and multiplier at the right hand, annex them to the product.

Examples.

1. Multiplicand.	123456	3	2	16743206	2
Multiplier.	23	5		45	0
	370368			83716030	
	246912			66972824	
Product.	2839488	6		753444270	0

3 Multiply	459406 by 594	Ans.	272887164
4	1234567 by 371		458024357
5	75656 by 798		60373488
6	89070532 by 592		52733306944
7	34678646 by 7864		272712872144
8	9656703 by 4578		44208386334
9	1234567890 by 345678		426762959079420
10	123456789 by 987654321		121932631112635269

RULE. 4. When there are cyphers on the right hand of the multiplicand, or multiplier, or in both, neglect those cyphers; then place the significant figures under one another, and multiply them only; add them together as directed in the foregoing rule, and place to the right hand as many cyphers as there are in both the multiplicand and multiplier.

Examples.

	1	2	3
Multiplicand	12360	956700	67910
Multiplier	2600	320	5600
	<u>7416</u>	<u>19134</u>	<u>40746</u>
	2472	28701	33955
	<u>32136000</u>	<u>306144000</u>	<u>380256000</u>

SIMPLE MULTIPLICATION.

4. 9436170 by 920 *Answer* 8681276400
 5. 3769410 by 4840 18200384400
 6. 815036000 by 70300 57297030600000

RULE 5. To multiply by 10, 100, 1000, 10000, &c. bring down the multiplicand underneath, and annex the cyphers in your multiplier to the right hand of them.

Examples.

	1.	2.
Multiplicand	33676767	767646120
Multiplier	10	100
Product	<u>336767670</u>	<u>7676461200</u>
	3.	
	16789876	36747631
	1000	10000
	<u>16789876000</u>	<u>367476310000</u>

RULE 6. To multiply 99, 999, &c. in one line; place as many dots to the right hand of the multiplicand, as there are figures of 9 in your multiplier, which dots suppose to be cyphers; then, beginning with the right hand dot, subtract the given multiplicand from the new one, and the remainder will be the total product.

Examples.

	1.	
Muld. 112065..	According to the rule, 112065..	Min.
Mul. 99	it will stand thus,	112065 Sub.
Prod. 11094435		<u>11094435</u>
	2.	
Muld. 676437...		676437...
Mul. 999		676437
Pro. 676760563		<u>675670563</u>

RULE 7. To multiply by 13, 14, 15, &c. to 19: place your multiplier at the right of the multiplicand, with the figure multiplication between them, and multiply with the unit figure only, of the multiplier, removing the product one figure

SIMPLE MULTIPLICATION.

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to the right hand of the multiplicand; add this line of figures to the multiplicand, and you have the product.

Examples.

$$\begin{array}{r} \text{1.} \\ \text{Multiplicand. } 128603 \times 13 \\ \text{Multiplier } 13. \quad 385809 \\ \hline \end{array}$$

$$\text{Product. } \underline{\underline{1671839}}$$

$$\begin{array}{r} \text{2.} \\ 767060 \times 14 \\ \text{14. } 3068240 \\ \hline \end{array}$$

$$\text{Product. } \underline{\underline{10738840}}$$

3. Multiply 34678 by 15. *Answer,*
 4. 67432 by 16.
 5. 16072 by 17.
 6. 21376 by 19.

RULE 8. To multiply by 101, 102, &c. to 109—multiply by the right hand figure only of the multiplier, removing the product two figures to the right hand of the multiplicand, then add all together, and the sum will be the total product. In the same manner proceed with 1001, 1002, &c. removing the product three figures.

Examples.

$$\begin{array}{r} \text{1.} \\ \text{Multiplicand. } 4674 \times 101 \\ \text{Multiplier. } 101 \quad 4674 \\ \hline \end{array}$$

$$\text{Product. } \underline{\underline{472074}}$$

$$\begin{array}{r} \text{2.} \\ 6321 \times 102 \\ \text{102. } 12642 \\ \hline \end{array}$$

$$\text{Product. } \underline{\underline{644742}}$$

- 3 Multiply 3620 by 104 *Answer.*
 4 7206 by 105
 5 13655 by 106
 6 12006 by 109

$$\begin{array}{r} \text{7 Multiplicand.} \\ \text{Multiplier. } 1004 \\ \hline \end{array}$$

$$\begin{array}{r} 37406 \times 1004 \\ 149624 \\ \hline \end{array}$$

$$\text{Product.}$$

$$\underline{\underline{37555624}}$$

- 8 Multiply 47471 by 1005 *Answer.*
 9 74740 by 1006
 10 31098 by 1009

RULE 9. To multiply by 21, 31, 41, &c. to 91—multiply by the ten's figure only of the multiplier, and set the unit figure of the product under the place of tens, add them all together, and their sum will be the total product.

Examples.

1	Multiplicand.	70163	×	21		2.	36503	×	31
	Multiplier.	(12) 140326					(31) 109509		
	Product.	1473423					1131593		
3	Multiply	16730	by	41	<i>Answer.</i>				
4		96432	by	51					
5		64731	by	81					
6		32000	by	91					

Practical questions in Simple Multiplication.

1. How many dollars will purchase a drove of cattle consisting of three hundred head, at 10 Dollars each?

Answer—3000.

2. How many Eagles will purchase one hundred Horses, at 9 Eagles each?

Answer—900.

3. How many Dimes will pay for two hundred and forty Pen Knives, at eight Dimes each?

Answer—1920.

4. How many Dollars must be given for a tract of land containing 510 acres, at ten Dollars per acre?

Answer—5100.

5. How many Tobacco hills are in a piece of land where the rows are four hundred and eighty-six hills long, and 221 wide?

Answer—107406.

6. If you purchase 50 barrels of Corn at 3 Dollars per barrel, how many dollars will you have to pay?

Answer—150.

7. Suppose 60 men were concerned in the payment of a debt, and each man paid 4500£. how much was the debt?

Answer—270000.

8. How many square feet are in a floor 36 feet in length, and thirty in breadth?

Answer—1080.

9. A merchant bought 18 bales of cloth, in each bale 40 pieces, and in each piece 22 yards; how many yards in the whole?

Answer—15840.

10. What is the product of twice five and twenty, by twice 25?

Answer—1500.

11. If the Virginia Legislature consist of 180 members, and each member sits 40 days in session, and receives 3 Dollars per day, what sum will they draw from the treasury?

Answer—21000 dols.

Simple Division.

SIMPLE DIVISION teaches to find how many times one number is contained in another, and generally consists of the following terms, viz:

The dividend, or sum to be divided.

The divisor, or number by which you divide.

The quotient, or answer, which shews how many times the divisor is contained in the dividend.

The remainder which is always less than the divisor.

If the divisor does not exceed 12, the operation is best performed in one line, and is denominated *short division*.

RULE 1. Consider how many times the divisor is contained in the first figure or figures of the dividend, put the result under, and carry as many tens to the next figure as there are one's over, divide every figure in the same manner till the whole be finished.

PROOF: Multiply the quotient by the divisor, taking in the remainder, when the work is right it will produce the dividend.

Examples.

Divisor. 2) 4736476432

Quotient. 2368238216

Proof. 4736476432

4) 7164320650

6) 4132006753

3) 7486486486

2495495495 $\frac{1}{3}$

7486486486

5) 3767123054

7) 1140326416

SIMPLE DIVISION.

$\begin{array}{r} 8) 7310567867 \\ \hline \\ \hline \\ \hline \end{array}$	$\begin{array}{r} 9) 1899189273 \\ \hline \\ \hline \\ \hline \end{array}$
$\begin{array}{r} 11) 3016789822 \\ \hline \\ \hline \\ \hline \end{array}$	$\begin{array}{r} 12) 8526050760 \\ \hline \\ \hline \\ \hline \end{array}$

RULE 2. When the divisor is the exact product of any two numbers in the multiplication table, first divide by one of them, then that quotient by the other, and multiply the first divisor into the last remainder, if any, and to that product add the first remainder for the true one.

PROOF. Multiply by the same numbers, and in the same order in which you divide, observing to take in the remainder.

Examples.

1. $3 \times 5 = 15$ $\begin{array}{r} 3) 56715 \\ \hline 5) 18905 \\ \hline \text{Quotient. } 3781 \\ \hline 5 \\ \hline 18905 \\ \hline 3 \\ \hline 56715 \\ \hline \hline \end{array}$	2. $5 \times 7 = 35$ $\begin{array}{r} 7) 634214 \\ \hline 5) 90602 \\ \hline 18120 \ 2 \\ \hline 5 \\ \hline 90602 \\ \hline 7 \\ \hline 634214 \\ \hline \hline \end{array}$
---	--

3 Divide 3667828800 by 48 4 2463569856 by 84 5 740043612 by 96 6 57384659 by 144	<i>Answer</i>—76413100 29328212.4 Rem. 7708787.60 398504.83
---	---

RULE 3. When the divisor exceeds 12, it is called *long division*, and in this case you must set down your divisor to the left hand of the dividend, and consider how many times the divisor is contained in as many figures of the dividend, as is necessary, and place that number on the right of the dividend, for the first figure of the quotient, multiply the divisor by this number, and place the product under the left hand figures of the dividend, subtract this product from the divi-

SIMPLE DIVISION.

15

dividend, and call it the first remainder, which must be less than the divisor; bring down the next figure of the dividend, and place it to the right of the remainder, and proceed in the same manner with the other figures in the dividend, until you bring them all down.

PROOF. By multiplication, as in short division, or by excesses of nines, as follows, make a cross thus $\times$ cast the 9's out of the divisor, and place the excess on the left hand of the cross—do the same with the quotient, and place the excess on the right, multiply these two figures together, and add their product to the remainder; reject the nines, and place the excess at top; cast the nine's out of the dividend, and place the excess at bottom, and if the top and bottom figures are alike, the work is right.

Examples.

	Dividend.	Quotient.	
1. Divisor	45)6371603(	— 141591	
	45	45	
	187	707963	
	180	566364	
	71	6371603	Proof by Mult.
	45		
	266		
	225		
	410		
	405		
	53		
	45		
Remainder	8		

SIMPLE DIVISION.

	Dividend.	Quotient.
2. Divisor 67	17654321	263497
	134	
	425	
	402	
	234	
	201	
	333	
	268	
	652	
	603	
	491	
	469	
Remainder.	22	

$$\begin{array}{r} 2 \\ 4 \times 4 \text{ Proof by excess of nine's} \\ 2 \end{array}$$

			Quotient.	Remr.
3	Divide 486873486 by	89	<i>Answer</i> ---5470488	54
4	15378901 by	87	176768	85
5	17865109 by	97	184176	37
6	7864863 by	386	20375	113
7	5374608 by	671*	8009	569
8	796741035982 by	73469	10844588	210
9	756390289 by	41659	18156	29485

RULE 4. When one or more cyphers occur at the end of the divisor, omit them in the operation, separating from the right of the dividend as many figures, which annex to the last remainder.

Examples.

	Dividend.	Quotient.
2. Divisor	65 00)3794 32	58
	325	
	544	
	520	
	2432	
	Remainder.	

		Quotient.	Rem.
2	Divide 7126131242 by 62500	Ans---114018	6242
3	1716131815252 by 412000	4165368	199252
4	1742367426 by 6731000	258	5769426

Practical questions in Simple Division.

1. If 12 boys divide 1800 Chestnuts among themselves equally, how many will each have? *Answer*—150.
2. If thirty merchants draw from the bank 18700 dollars to be equally divided among themselves, how many must each have? *Answer*—6233 $\frac{1}{3}$.
3. A Cow driver sells 384 head of cattle for 3456 dollars, how much does he get for each? *Answer*—9 dols.
4. Divide £25000 among 250 men, and shew what one should have? *Answer*—£100.
5. If 5 Legatees divide 2045 acres of land among themselves, how many acres will each have? *Answer*—409.
6. A Horse driver purchased 45 Horses for 2475 dollars, how much does one cost him, supposing them on an average? *Answer*—55 dols.
7. If 77 hhds. of Sugar cost 7777 dollars, how many will one cost? *Answer*—101 dols.
8. If 12 men have £672 divided among them, how much will each man have? *Answer*—£56.
9. A person intending to travel 3400 miles, would go it in 68 days, how many miles must he travel each day? *Answer*—50.
10. Several boys went to gather peaches, and collected 5130, which when shared among them, each had 855; how many boys were in company? *Answer*—6.
11. If the expence of erecting a bridge be 5022 dollars, to be defrayed equally by 93 men, how much must be the quota of each? *Answer*—45 dols.
12. If there are 589,000,000 acres of land in the United States, and 589000 families, how many acres would each family have if it was equally divided among them? *Answer*—1000 Acres.

Compound Addition.

COMPOUND ADDITION teaches to find the sum total of several sums having divers denominations, but of same quality as money, weights, measures, &c.

RULE. Place the numbers of the same denomination under each other, and separate them by two strokes, thus (") keeping the lowest denomination to the right hand.

Then, add up the right hand column, divide the sum by as many of that denomination as makes one of the next; put down the remainder, if any, under said column, and carry the quotient to the next, &c.

PROOF. Cut off the upper line; and repeat the operation as in Simple Addition.

United States Money.

THE DENOMINATIONS ARE;

10 <i>Mills</i>	(Marked <i>m</i>)	make	1 <i>Cent.</i>	<i>c.</i>
10 <i>Cents</i>			1 <i>Dime.</i>	<i>d.</i>
10 <i>Dimes</i>			1 <i>Dollar.</i>	<i>\$</i>
10 <i>Dollars</i>			1 <i>Eagle.</i>	<i>Ea.</i>

The Standard Weight.

			<i>dst.</i>	<i>grs.</i>	
A Dime	-	-	-	1	16 $\frac{2}{3}$ Silver.
A Dollar	-	-	-	17	1 $\frac{1}{4}$
A Half Eagle	-	-	-	5	14 $\frac{1}{2}$ Gold.
An Eagle	-	-	-	11	4 $\frac{2}{3}$

NOTE. The Federal Standard for Gold and Silver is 92 parts fine, and one part alloy.

Examples.

<i>Ea.</i>	<i>\$</i>	<i>dm.</i>	<i>c.</i>	<i>m.</i>	<i>Ea.</i>	<i>\$</i>	<i>dm.</i>	<i>c.</i>	<i>m.</i>
48	8	6	4	7	65	7	6	5	4
73	7	5	3	6	64	6	5	4	3
47	6	4	4	4	76	5	4	3	2
76	5	3	2	2	84	4	3	2	0
46	4	2	1	1	83	3	2	1	1
Total.									
293	2	1	6	0					
244	3	5	1	3					
Proof.									
293	2	1	6	0					

The government, and a considerable portion of the merchants of the United States (those of the north more particularly) keep their accounts in dollars and cents only, and setting down fums in this money as in the following examples, with a dot to separate the cents from the dollars, then add them as whole numbers.

Exempli gratia.

dols.	c.	dols.	c.	dols.	c.	dols.	c.
144	. 67	123	. 81	76	. 20	16	. 33
235	. 71	163	. 16	67	. 21	17	. 17
346	. 74	142	. 12	76	. 25	3	. 16
457	. 75	191	. 73	76	. 04	4	. 1
586	. 76	188	. 75	76	. 1		. 13
657	. 81	173	. 11				
2429	. 44						

There is another simple method of setting down dollars and cents, viz : Set down the dollars and cents as whole numbers, add them up and dot off the two right hand figures ; those on the left will be dollars, those on the right cents, as in the following.

Examples.

d. & c.	d. & c.	d. & c.	d. & c.
1 2 3 4 5 6	1 1 0 6 7	1 1 4 0 6	3 6 4 7 4
4 6 4 0 7	1 6 4 7 4	1 7 3 8 7	8 7 6 5 0
3 1 6 1 4	1 3 6 4 7	4 7 4 9 6	4 3 2 1 0
1 6 4 6	1 2 3 2 1	3 4 3 5 1	6 7 6 7 3
1 3 4	1 6 3 0 2	1 2 4 3 0	4 7 6 0 4
1 7	1 7 0 4 2	1 0 6 0 5	1 3 0 6 7
Dols. 2 0 3 2 . 7 4 cts.			

Practical questions in United States Money.

1. Add 120 Eagles and 9 Dollars, and 16 Eagles, 3 Dollars, 8 Dimes and 6 Cents together.

Answer—137ea. 2dols. 8d. 6c.

2. If you owe 1267 dols. 45 cts. to a merchant, and 1647 dols. 1 ct. for land, and 13 dols. 67 cts. to a neighbour, how much do you owe in all?

Answer—2928 dols. 13 cts.

COMPOUND ADDITION.

3. Laid out at sundry times, viz : at one time 1000 dollars, at another 50 cents, at a third 6 dollars and 50 cents, and lastly 190 dollars ; what is the whole sum expended?

Answer—1197 dols.

4. If I purchase goods to the value of 1674 dollars 12 cents, and land to the amount of 1075 dols. 60 cents, and have laid out 3075 dols. in bank stock ; what sum have I expended?

Answer—5824 dols. 72 cents.

5. Suppose a merchant on settling his accounts, finds he owes A. 666 dols. 25 cents, B. 2060 dols. 75 cents, C. 134 dols. 16 cents, and D. 34 dols. how much does he owe in all?

Answer—2895 dols. 16 cents.

6. Admit a person left his son 74600 dols. gave three nephews each 750 dols. 75 cents, 2 nieces each 600 dols. 50 cents, and to his servant 250 dols. what is the sum of his bequests?

Answer—78453 dols. 25 cents.

7. Bought 6 Horses for 75 dols. 50 cents each, and 3 yoke of Oxen at 40 dols. per yoke, and 5 barrels of Corn for 15 dols. 50 cents ; what is the amount?

Answer—588 dols. 50 cents.

8. Suppose a citizen going into the country ordered payment of the following bills. viz :—The Brewers 74 dols. 60 cents, the Bakers 60 dols. 75 cents. the Butchers 47 dols. 65 cents, the Drapers 44 dols. 25 cents, and his rent 72 dols. 75 cents ; for what sum must he draw on his banker to defray these expences ?

Answer—300 dols.

Virginia Currency.

The denominations are		marked
4 Farthings (marked qr.)	make 1 Penny,	d.
12 Pence	1 Shilling,	s.
20 Shillings	1 Pound,	£.

Pence Table.

Table of Shillings.

<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>Shillings make</i>	<i>l.</i>	<i>s.</i>	
20. pence make	1	:	8	20	1	:	0
30	2	:	6	30	1	:	10
40	3	:	4	40	2	:	0
50	4	:	2	50	2	:	10
60	5	:	0	60	3	:	0
70	5	:	10	70	3	:	10
80	6	:	8	80	4	:	0
90	7	:	6	90	4	:	10
100	8	:	4	100	5	:	0
110	9	:	2	110	5	:	10
120	10	:	0	120	6	:	0
130	10	:	10	130	6	:	10
140	20	:	00	140	7	:	0

Examples.

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
179	4	10	179	13	6 $\frac{1}{4}$	137	10	11 $\frac{1}{2}$
16	9	9	698	14	10 $\frac{1}{2}$	147	11	9 $\frac{1}{2}$
34	18	5	648	16	11 $\frac{1}{2}$	744	12	8 $\frac{1}{2}$
37	15	6	644	10	8 $\frac{1}{2}$	640	13	7 $\frac{1}{2}$
42	17	2	848	16	6 $\frac{1}{4}$	753	6	0 $\frac{1}{2}$
30	6	7	744	17	3 $\frac{1}{2}$	804	7	7
31	10	4	648	18	4 $\frac{1}{2}$	711	4	6 $\frac{1}{4}$
Total 373	2	7	4414	8	2 $\frac{1}{2}$			
<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
763	16	6 $\frac{1}{2}$	674	13	7 $\frac{1}{2}$	44	17	8 $\frac{1}{2}$
437	13	3 $\frac{1}{4}$	476	14	6 $\frac{3}{4}$	74	0	4
647	14	2 $\frac{3}{4}$	333	17	4 $\frac{1}{2}$	47	16	0 $\frac{1}{2}$
813	11	9 $\frac{1}{2}$	676	16	3 $\frac{1}{4}$	7	15	6
716	18	7 $\frac{1}{2}$	389	9	0	16	0	7 $\frac{1}{2}$
675	19	6 $\frac{1}{4}$	116	0	11	43	3	0 $\frac{1}{4}$
437	16	3 $\frac{1}{2}$	134	6	9 $\frac{1}{2}$	34	1	7 $\frac{1}{2}$

Practical Questions in Virginia Currency.

1. Suppose a Merchant on settling his books finds, he owes A. one hundred and thirty pounds, sixteen shillings and six pence; B. five hundred twenty-two pounds, five shillings; C. nine hundred and forty-two pounds, eighteen shillings and four pence half-penny; and D. seventy-five pounds, and five pence; how much does he owe in all?

A.	130	16	6
B.	522	5	0
C.	942	18	4½
D.	75	0	5

Answer, 1671 0 3½

2. If I have a person's bond for £1674 18 9½, and Interest due thereon £175 1 2½; how much is the amount?

Answer—£1850.

3. E. F. and G. purchased a quantity of merchandize in partnership; E. paid £1674 16 7½, F. £150 16 7, and G. £1274 6 9½; what did the merchandize cost?

Answer—£3100.

4. Suppose a Merchant buys 150 Hhds. of Tobacco for £3000. loading, unloading, storage, and drayage cost him £47 16 8, and freight £27 13 4; how much do the cost and charges amount to?

Answer—£3075 10.

5. Suppose a man borrowed a sum of money, and paid in part at one time, £34 16 3; at another, £47 14 6; at a third time, £37 13; and the remainder is £63 17 3; what was the sum borrowed?

Answer—£184 1.

6. Admit that I have purchased a tract of land for £676 10; property in town to the value of £2037; goods amounting to £347 3 9; and have laid out £1647 15 3 in Bank Stock; What sum have I laid out?

Answer—£4708 15.

7. Suppose A. owes me £47 16 3½; B. £56 4 4; C. £102 15; D. £120 13 4½; and E. £23 12 1½; what is the total due me?

Answer—£354 1 1.

Troy Weight.

THE DENOMINATIONS ARE:

24	Grains (<i>grs.</i>)	make	1 Pennyweight	<i>dwt.</i>
20	Pennyweights		1 Ounce	<i>oz.</i>
12	Quinces		1 Pound	<i>lb.</i>

By this table are weighed, Gold, Silver, Liquors, &c.

Examples.

<i>lb. oz. dwt. gr.</i>	<i>lb. oz. dwt. gr.</i>	<i>lb. oz. dwt. gr.</i>
345 9 14 19	7 2 12 13	8 1 16 17
646 8 13 18	6 1 13 10	7 2 15 16
647 7 12 17	5 3 14 16	6 3 14 15
648 6 11 16	4 4 15 17	5 4 13 14
349 5 10 15	3 5 16 18	4 5 12 13
450 4 9 14	2 6 17 21	3 6 11 12

Practical questions in Troy Weight.

1. A Goldsmith bought 5 ingots of Silver, two of which weighed each 8lb. 7oz. 11dwt. and each of the rest 8lb. 4oz. 16dwt. 16grs. how much did the whole weigh?

Answer—32lb 5oz. 8dwt.

2. Admit I have 3 tankards weighing each 8oz. 18dwt. Spoons weighing 6lb. 6oz. 2dwt. 20grs. 4 Salvers, each 4lb. 6oz. 21dwt. 2grs. what is the weight of the whole?

Answer—27lb. 10z. 1dwt. 4grs.

3. Suppose a Silversmith fold 12 dishes weighing 20lb. 2oz. 12dwt. 2grs. 24 plates weighing 41lb. 2oz. 11dwt. 10grs. 2 Tea Pots, each 3lb. 6oz. 11dwt. what is the weight of them all?

Answer—68lb. 6oz. 5dwt. 12grs.

4. Bought 6 dishes weighing 13lb. 4oz. 16dwt 11grs. Plates weighing 16lb. 3oz. 11dwt. 4grs. Salts 3lb. 14dwt. 9grs. what is the weight of the whole?

Answer—32lb. 9oz. 2dwt.

Apothecaries Weight.

THE DENOMINATIONS ARE:

20 Grains (<i>gr.</i>)	make	1 Scruple	<i>scr.</i>
3 Scruples		1 Dram	<i>dm.</i>
8 Drams		1 Ounce	<i>oz.</i>
12 Ounces		1 Pound	<i>lb.</i>

Medicines are compounded by this table, but drugs are bought and sold by Averdupois.

Examples.

lb.	oz.	dm.	sc.	gr.	lb.	oz.	dm.	sc.	gr.
44	9	7	2	19	57	11	6	1	11
45	8	1	0	18	58	16	5	1	12
46	7	2	1	17	59	9	4	1	13
47	6	3	1	16	60	8	3	1	14
48	5	4	1	15	61	7	2	1	15
49	4	5	1	14	62	6	1	1	16

Practical questions in Apothecaries Weight.

1. If I mix several simples together—1st. 2 ounces, 4 drams, 3 scruples—2d. 6 ounces, 2 drams, 1 scruple—and 3dly. 6 drams, 16 grains, how much do they all weigh?

Answer—9oz. 5dm. 8sc. 16gr.

2. If a druggist mix several medicines together, No. 1 weighing 17 pounds, 6 ounces, 4 drams, 1 scruple, No. 2, 4 ounces, 3 drams, 2 scruples, 16 grains, and No. 3, 11 ounces, 7 drams, 2 scruples, 4 grains; how much will they weigh;

Answer—18lb. 11oz.

Averdupois Weight.

THE DENOMINATIONS ARE:

16 Drains (<i>dr.</i>)	make	1 Ounce	oz.
16 Ounces		1 Pound	lb.
28 Pounds		1 Quarter of an cwt.	qr.
4 Quarters, or <i>112lb.</i>		1 Hundred weight	cwt.
20 Hundred weight		1 Ton	T.

By this weight are weighed all coarse and droffy goods, viz:—Groceries, Chandlery wares, Bread, and all metals except Gold and Silver.

Examples.

T.	cwt.	qr.	lb.	oz.	dr.	T.	cwt.	qr.	lb.	oz.	dr.
346	15	2	18	10	8	892	9	0	14	11	1
457	14	1	17	11	9	893	8	1	13	10	2
568	13	1	19	12	10	642	7	1	12	9	3
679	12	1	20	13	11	643	6	2	11	8	4
790	11	1	21	14	12	644	5	1	10	7	5
891	10	2	22	11	13	645	4	2	9	6	6

Practical questions in Averdupois Weight.

1. If I purchase 3 hhds. of Sugar, weighing as follows, viz : No. 1, eight hundred, two quarters, twenty pounds—No. 2, seven hundred, one quarter, twelve pounds—No. 3 nine hundred and nineteen pounds ; how much do they all weigh?

Answer—1 T. 5 cwt. 0 qr. 23 lb.

2. Sold 4 bags Pimento, weighing, viz :—1st. 2 quarters, 19 pounds, 14 ounces, 11 drams—2d. 3 quarters, 2 pounds, 11 ounces, 9 drams—3d. three hundred, one quarter, ten pounds, nine ounces, eight drams—4th. three quarters, eighteen pounds, eleven ounces, twelve drams ; what are their weight?

Answer—5 cwt. 2 qr. 23 lb. 15 oz. 8 dr.

Cloth Measure.

THE DENOMINATIONS ARE :

2 $\frac{1}{2}$ Inches (in.)	make	1 Nail	na.
4 Nails		1 Quarter	qr.
4 Quarters		1 Yard	yd.
3 Quarters		1 Ell Flemish	e. fl.
5 Quarters		1 Ell English or French	ee. ef.
2 $\frac{1}{2}$ Quarters or 10 nails		1 Ell Hamburg	e. b.

By this measure, Cloths, Tapes, &c. are measured.

Examples.

yd.	qr.	na.	e.	e.	qr.	na.	e.	f.	qr.	na.
1806	3	1	84	3	2	78	1	1		
784	2	1	83	1	1	77	1	1		
386	1	1	82	1	1	76	1	2		
436	0	1	81	1	1	75	1	2		
187	1	1	80	1	1	74	2	2		
145	1	2	79	2	1	73	1	2		

Practical questions in Cloth Measure.

1. Bought 3 pieces Linen, viz :—No. 1, 24 yards, 2 quarters, 3 nails—No. 2, 22 yards, 1 quarter, 1 nail—and No. 3, 25 yards, 2 quarters, 2 nails ; what quantity have I purchased?

Answer—72 yd. 2 qr. 2 na.

2. Suppose a Merchant bought 16 bales of Cloths, containing as follows, viz:—No. 1, 2, each 250 yards, 2 quarters—No. 3, 4, 5, 6, 7, 8, 9, 10, each 310 yards, 2 nails, and each of the rest 411 yards, 1 quarter, 1 nail; query, the total?

Answer—5449 yds. 3qr. 2na.

3. If I purchase 2 pieces Holland, the first containing 54 yards, 2 quarters, and the second 67 yards, 2 quarters, how many yards shall I have to pay for?

Answer—122 yards.

Long Measure.

THE DENOMINATIONS ARE:

3	Barley Corns (<i>b. c.</i>)	make	1 Inch	<i>in.</i>
12	Inches	-	1 Foot	<i>ft.</i>
3	Feet	-	1 Yard	<i>yd.</i>
5½	Yards	-	1 Rod, pole, or perch	<i>p.</i>
40	Poles (or 220 yds.)	1	Furlong	<i>fur.</i>
8	Furlongs (or 1760 yds.)	1	Mile	<i>m.</i>
3	Miles	-	1 League	<i>l.</i>
60.	Geographic	} miles	1 Degree	<i>deg.</i>
	or			
69½	Statute			
360	Degrees the circumference of the earth.			

This measure is used to measure lengths or distances.

Examples.

<i>deg.</i>	<i>l.</i>	<i>fur.</i>	<i>p.</i>	<i>yd.</i>	<i>ft.</i>	<i>in.</i>	<i>bc.</i>
9	45	7	31	321	2	11	2
8	46	6	32	422	1	10	2
7	47	5	33	534	1	9	1
6	48	4	34	645	1	8	1
5	49	3	35	756	1	7	1
4	50	2	36	867	1	6	1

Practical questions in Long Measure.

1. If from Richmond to Hopkin's be 22 miles, 3 furlongs, 30 poles, from thence to Powhatan Court-house 11 miles, 2 furlongs, 2 poles, and from thence to Cumberland Court-house

24 miles, 8 poles, how far distant is Richmond from Cumberland Court-house.

Answer—57 M. 6 fur.

Land Measure.

THE DENOMINATIONS ARE;

9	Square feet (ft.)	make	1	Yard	yd.
30 $\frac{1}{4}$	Yards	-	1	Perch	P.
40	Perches	-	1	Rood	Ro.
4	Roods	-	1	Acre	A.

By this table lands are measured.

Examples.

A.	Ro.	A.	A.	Ro.	P.
35	3	21	16	2	31
46	2	20	17	2	32
57	1	19	18	3	33
68	1	18	19	2	34
79	1	17	29	1	35
81	1	16	21	1	36

Practical questions in Land Measure.

1. If one field contain 47 acres, 2 roods, 17 perches—another 37 acres, 2 roods, 39 perches—and a third 61 acres, 24 perches; what quantity in all?

Answer—146 A. 2 Ro.

2. Admit a person has one field in Corn containing 36 acres, 23 perches—another in rye 24 acres, 2 roods—2 in oats, each 18 acres, 1 rood, 11 perches—a pasture containing 103 acres, 1 rood—a meadow 64 acres, 1 rood, and wood land 432 acres, 2 roods, 11 perches; how much land does he own?

Answer—697 A. 1 R. 16 P.

COMPOUND ADDITION,

Dry Measure.

THE DENOMINATIONS ARE:

2 Pints (<i>pt.</i>)	make	1 Quart	<i>qt.</i>
4 Quarts	- - -	1 Gallon	<i>gal.</i>
2 Gallons	- - -	1 Peck	<i>pk.</i>
4 Pecks	- - -	1 Bushel	<i>bus.</i>
5 Bushels	- - -	1 Barrel	<i>bar.</i>

This measure is used for grain, fruit, salt, &c.

Examples.

<i>bar. bus. pk.</i>	<i>bar. bus. pk. gal. qt.</i>
465 3 3	36 2 3 1 3
466 2 2	31 2 2 1 2
467 1 1	17 3 1 1 1
333 0 0	48 2 0 1 1
312 4 2	65 4 1 1 1
316 3 2	73 1 1 1 1

Practical Questions in Dry Measure.

1. Add 33 barrels, 4 bushels, 3 pecks, 1 gallon—26 barrels, 3 bushels, 1 peck, 1 gallon—to a granary that contains 432 barrels, 4 bushels of corn, and tell the amount?

Answer—490 *bar.* 2 *bus.* 0 *pk.* 1 *gal.*

2. Admit a man has 6 hogheads of wheat, each containing 25 bushels, 1 peck, and in a granary 375 bushels, 3 pecks; what quantity has he?

Answer—527 *b.* 1 *pk.*

Liquid Measure.

THE DENOMINATIONS ARE:

2 Pints (<i>pt.</i>)	make	1 Quart	- - - - -	<i>qt.</i>
4 Quarts	- - -	1 Gallon	- - -	<i>gal.</i>
63 Gallons	- - -	1 Hhd. of brandy or wine	- - -	<i>hhd.</i>
2 Hogheads	- - -	1 Pipe or Butt	- - -	<i>pi. or bt.</i>
2 Pipes or 4 Hhds.	- - -	1 Tun	- - -	<i>T.</i>

This measure is used for Beer, Cider, Wine, Brandy Rum, &c.

Examples.

<i>T. bhd. gal.</i>	<i>gal. qt. pt.</i>	<i>gal. qt. pt.</i>
3 3 41	126 3 1	132 2 1
7 2 42	127 2 1	134 2 1
4 1 43	128 1 1	147 1 1
3 1 44	129 1 1	148 1 1
2 1 45	130 1 1	167 1 1
1 2 46	131 1 1	143 1 1

Practical questions in Liquid Measure.

1. Suppose a merchant purchases 3 hogheads of Brandy, gauging as follows, viz:—No. 1, 120 gallons, 2 quarts, 1 pint—No. 2, 121 gallons, 1 quart—and No. 3, 118 gallons, 1 pint, how much do they contain? *Answer—360gal.*

2. Sold 5 hogheads of Wine, 3 of which contained each 121 gallons, 1 quart, 1 pint—and each of the others 67 gallons, 2 quarts, 1 pint; what quantity in them all? *Answer—499gal. 1qt. 1pt.*

Time.

THE DENOMINATIONS ARE:

60 Seconds (<i>sec.</i>)	make	1 Minute	<i>min.</i>
60 Minutes	- - -	1 Hour	<i>b.</i>
24 Hours	- - -	1 Day	<i>da.</i>
7 Days	- - -	1 Week	<i>w.</i>
4 Weeks	- - -	1 Month	<i>mo.</i>
13 Months 1 Day and 6 Hours	- - -	1 Year	<i>yr.</i>

NOTE. A common year consists of 365 days, and every fourth called leap year, of 366.

The year is also divided into 12 Calendar months, as follows:

No more days than thirty hath September,
 The same hath April, June and November;
 The rest have just thirty and one,
 Except the month February alone,
 Which claimeth just eight and a score,
 Except leap year, when we give it one more.

COMPOUND ADDITION.

yr.	mo.	w.	da.	da.	b.	min.	sec.
412	10	3	3	216	16	51	32
416	9	2	4	312	17	52	33
375	8	1	3	162	18	53	34
476	7	0	4	173	19	54	35
134	6	1	6	184	12	55	36
618	5	2	5	195	13	56	9

Practical questions in Time.

1. What day of the year was the 20th of May 1807?

Answer—140th.

2. Admit A. to be 47 years 3 months 2 weeks 3 days old, and B. 20 years 3 months 1 week 21 days old; what is the sum of their ages?

Answer—67yr. 7mo. 2w. 3d.

Motion, or Circle Measure.

THE DENOMINATIONS ARE:

60 Seconds (")	make	1 Minute	
60 Minutes	-	1 Degree	o
30 Degrees	-	1 Sign	sig.
12 Signs, or 360 degrees,		one revolution or circle.	
This is used by astronomers, navigators, &c.			

Examples.

o	'	"	sig.	o	'	"
16	36	47	6	16	31	41
17	32	46	5	15	30	40
14	41	47	4	14	29	39
13	52	48	3	13	28	38
12	33	49	2	12	27	37
11	31	50	1	11	26	36

Practical Question.

1. Add 6 signs, 16 degrees, 30 minutes, 40 seconds and 17 degrees, 41 minutes, 20 seconds together, and tell their sum?

Answer—7 sig. 4° 12'

Compound Subtraction.

COMPOUND SUBTRACTION teaches to take one quantity of several denominations from a greater of like quality.

RULE. Place the lesser line under the greater, keeping the proper denominations under each other, then subtract the under from the upper; if the upper number be less than the under, borrow as many of that denomination as make one of the next greater, and to the remainder add the upper number; set down the result, and carry one to the next, &c.

PROOF. As in Simple Subtraction.

United States Money.

Examples.

	<i>Ea.</i>	<i>¢</i>	<i>d.</i>	<i>c.</i>	<i>m.</i>
Minuend.	64	1	5	0	4
Subtrahend.	16	7	6	3	2
Remainder.	47	3	8	7	2
Proof.	64	1	5	0	4

	<i>¢</i>	<i>c.</i>	<i>¢</i>	<i>c.</i>	<i>¢</i>	<i>c.</i>
Minuend.	1676	- 10	1805	- 90	16745	- 35
Subtrahend.	987	- 80	763	- 95	7656	- 75
Remainder.	688	- 30				
Proof.	1676	- 10				

Practical Questions.

1. If I owed a merchant at Richmond 16740¢ 75 cents, and have remitted him 100 eagles; what balance is due him?

Answer—15740¢ 75 cents.

2. If I have sent 2706 dollars to the Virginia Bank, and have drawn checks for 67 dollars 16 cents; 169 dollars 74 cents, and 37 dollars 50 cents; what further sum may I draw for?

Answer—2432¢ 60 cents.

Virginia Currency.

	<i>£</i>	<i>s.</i>	<i>d.</i>	<i>£</i>	<i>s.</i>	<i>d.</i>
Minuend.	1675	16	7½	13674	11	6½
Subtrahend.	784	19	8½	9865	12	8½
Remainder.	890	16	11½			
Proof.	1675	16	7½			

Practical Questions.

1. If I have in possession 58*l.* 1*s.* 9*d.* and pay away, and spend together 27*l.* 10*s.* 11*d.* what sum should I have remaining?

Answer—557*l.* 3*s.* 10*d.*

2. Suppose a planter's account with a merchant be 3 hundred pounds, the merchant's account with the planter 4 hundred and twenty pounds ten shillings; who is the person indebted, and how much?

Answer—120*l.* 10*s.* Merch't.

3. Bought merchandise amounting to one hundred pounds, and paid at one time 66*l.* 19*s.* 11*d.* ¼ and at another time 33 pounds; what balance will discharge the debt?

Answer—¼

Troy Weight.

	<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>	<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>
Minuend.	567	6	11	15	1648	6	10	13
Subtrahend.	128	7	11	16	959	9	6	14
Remainder.	438	10	19	23				
Proof.	567	6	11	15				

Practical questions.

1. From 467*lb.* 8*oz.* 6*gr.* take 167*lb.* 9*oz.* 21*gr.* and shew the remainder?

Answer—299*lb.* 10*oz.* 9*gr.*

2. Bought 604 pounds of plate and have sold 264 pounds 9 ounces 12 grains of the same; how much have I left?

Answer—339*lb.* 20*oz.* 12*gr.*

COMPOUND SUBTRACTION.

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Apothecaries Weight.

	lb.	oz.	dr.	sc.	gr.		lb.	oz.	dr.	sc.	gr.
Minuend.	624	11	6	1	14		1368	6	3	1	16
Subtrahend.	146	4	6	0	15		679	7	2	1	19
Remainder.	478	7	0	0	19						
Proof.	624	11	6	1	14						

Practical questions.

1. From 6lb. 3oz. 4dr. 0sc. 16gr. taking 3lb. 4oz. 6dr. 1sc. 16gr. what will be left?

Answer—2lb. 10oz. 6dr. 1sc. 17gr.

2. If 3 parcels, each 3 pounds 2 ounces 4 drams, 2 scruples 10 grains be taken out of a parcel of medicine containing 23 pounds, what quantity will be left?

Answer—13lb. 4oz. 1dr. 1sc. 14gr.

Averdupois Weight.

	cwt.	qr.	lb.	oz.	dr.		cwt.	qr.	lb.	oz.	dr.
Minuend.	465	3	19	12	11		765	2	16	13	12
Subtrahend.	176	0	15	13	14		176	3	2	14	13
Remainder.	289	3	3	14	13						
Proof.	465	3	19	12	11						

Practical Questions.

1. If I have 16 ton 13 cwt. of Iron, and sell 10 ton 16 cwt. 2 quarters, how much have I left?

Answer—5T. 16cwt. 2qr.

2. If a grocer purchased 35 cwt. of cheese, and sells 21 cwt. 3qr. and 11lb. how much has he on hand?

Answer—14cwt. 0qr. 17lb.

COMPOUND SUBTRACTION.

Cloth Measure.

	yd.	qr.	na.	ec.	qr.	na.	ef.	qr.	na.
Minuend.	645	1	2	825	1	1	176	1	2
Subtrahend.	176	1	3	646	2	3	78	0	3
Remainder.	468	3	3						
Proof.	645	1	2						

Practical Questions.

1. From 742 yards, take 163 yards 2qr. 1 nail, and shew the remainder? *Answer—578yd. 2qr. 3na.*

2. Bought 4 pieces cloth; each 24 yards 2 quarters 2 nails, of which have been sold 2 pieces and 10 yards of another, what quantity is there on hand? *Answer—39yds. 1qr.*

Long Measure.

	le.	m.	fr.	po.	yd.	ft.	in.	bc.
Minuend.	47112	1	4	15	467	2	6	1
Subtrahend.	12643	0	6	20	376	1	7	2
Remainder.	34469	0	5	35				
Proof.	47112	1	4	15				

Practical Questions.

1. From 60 leagues 2 miles 1 furlong, take 16 leagues 1 mile 4 furlongs, and shew the remainder? *Answer—44le. 0m. 5fr.*

2. If you take 21 degrees 41 minutes 4 furlongs 21 poles, from 44 degrees, what will remain? *Answer—22deg. 18m. 3fr. 19po.*

Land Measure.

	a.	r.	p.	a.	r.	p.	a.	r.	p.
Minuend.	687	3	17	60	0	16	16	1	12
Subtrahend.	432	1	28	16	1	30	9	2	16
Remainder.	255	1	29						
Proof.	687	3	17						

Practical Questions.

1. What difference between one field containing 64 acres 2 rods 36 poles, and another which contains 136 acres?

Answer—71a. 1r. 4p.

2. If my father has given my brother Albert 2500 acres 2 rods 1 pole, and myself 1364 acres 2 rods, What difference in his land bequests?

Answer—1136a. 0r. 1p.

Dry Measure.

	bar.	bus.	p.	bar.	bus.	p.	gl.	qt.
Minuend.	64364	2	1	67	1	1	1	1
Subtrahend.	9876	3	2	36	2	3	0	1
Remainder.	54487	3	3					
Proof.	64364	2	1					

Practical Questions.

1. If a person has in one granary 134 barrels of corn, and in another 47 barrels 1 bushel 1 peck, how much more is there in one than the other?

Answer—86bar. 2bus. 3p.

2. A merchant has in one lumber-house 3000 bushels of wheat, and in another 1643 bushels 2 pecks, how much more is there in the one than the other?

Answer—1356bus. 2p.

COMPOUND SUBTRACTION.

Liquid Measure.

	<i>T. H. gal.</i>	<i>T. H. gal.</i>	<i>gal. qt. pt.</i>
Minuend.	67 2 41	36 1 40	47 3 0
Subtrahend.	36 2 47	27 2 29	16 2 1
Remainder.	30 3 57		
Proof.			

Practical Questions.

1. From 3 tuns of Wine, take 2 hogsheads 16 gallons 3 quarts?

Answer—27. 1bhd. 46gal. 1qt.

2. A merchant purchased several hogsheads of Rum containing 672 gallons, of which he sold 342 gallons 2 quarts 1 pint, how much is on hand?

Answer—329gal. 1qt. 1pt.

Time.

	<i>yrs. m. w. d.</i>	<i>b. min. sec.</i>
Minuend.	452 10 0 6	442 42 56
Subtrahend.	165 5 1 2	273 47 58
	287 4 3 4	
	452 10 0 6	

Practical Questions.

1. If in 24 hours you sleep 8 hours, take up one hour at dinner, and play 4 hours 6 minutes 24 seconds, how long do you have for business.

Answer—10b. 53m. 36sec.

2. If a man by agreement is to serve another 12 years, when he shall have served 11 years 11 months 3 weeks 6 days 23 hours 59 minutes 59 seconds, how long then has he to serve?

Answer—1 second.

3. How much older is William than Eliza? his birth happening on the 19th of December, 1796, and hers the 10th of August, 1807?

Answer—10yr. 7m. 15d.

Motion.

	°	'	"	sig.	°	'	"	°	'	"
Minuend.	9	40	51	10	16	46	11	6	12	53
Subtrahend.	7	47	16	6	19	47	30	4	55	46
Remainder.	1	53	35							
Proof.										

Practical Questions.

- From 6 sig. 20° 16' 50" take 4 sig. 11° 52' 59"
Answer—2 sig. 8° 23' 51"
- When a planet has moved through 11 sig. 29° 59' 59" of its orbit, how far short is it of a complete revolution?
Answer—1"

Compound Multiplication.

COMPOUND MULTIPLICATION teaches to multiply quantities of divers denominations.

GENERAL RULE—Multiply the lowest denomination by the given quantity, then consider how many of the next denomination are contained in the product, which carry to the next, setting down the remainder. Multiply each denomination in the same manner, and you will have the whole product required.

PROOF—Divide the product by the multiplier, and the quotient will be the multiplicand.

NOTE. Federal money may be multiplied or divided as whole numbers by any number whatever, observing to point off as many places to the right hand of dollars in the product, or quotient, as are in the sum so multiplied or divided.

Examples,

1.					2.				
	£	s	d.	c. m.		£	s	d.	
Multiplicand.	16	7	.	6 3 2		4678	.	16	
Multiplier.				2					3
Product.	2)	33	5	. 2 6 4					
Proof.		16	7	. 6 3 2					

3. Multiply 1348 16c. $\frac{1}{4}$	by 4.
4. Multiply 166l. 17s. 8d. $\frac{1}{2}$	by 6.
5. Multiply 144lb. 10oz. 16dwt. 4gr.	by 8.
6. Multiply 14T. 13cwt. 3qr. 27lb. 10oz. 8dr.	by 10.
7. Multiply 64cc. 2qr. 2s.	by 12.
8. Multiply 44yd. 2f. 6in. 1bc.	by 3.
9. Multiply 36bar. 2bus. 3pk. 1gl. 3qt.	by 5.
10. Multiply 641yr. 10m. 1w. 5d.	by 7.
11. Multiply 2sig. 23° 45' 55"	by 9.
12. Multiply 846l. 16s. 8d. $\frac{1}{2}$	by 5.
13. Multiply 907l. 9s. 9d. $\frac{1}{4}$	by 7.
14. Multiply 44lb. 9oz. 7dr. 2sc. 19gr.	by 9.
15. Multiply 646yd. 3qr. 2n.	by 11.
16. Multiply 6deg. 34m. 7f. 36p.	by 2.
17. Multiply 160a. 3r. 30p.	by 4.
18. Multiply 7T. 2bhd. 40gal. 2qt. 1pt.	by 6.
19. Multiply 40d. 20b. 30min. 36sec.	by 8.
20. Multiply 11sig. 20° 40' 51"	by 10.

When the multiplier is over 12, multiply by any two factors in the multiplication table, whose product equals the multiplier; thus, for 16 multiply by 4 and by 4—for 18, by 9 and 2, &c. &c.

1. Multiply	£	s.		by	16
	1676	50			
		4			
	6706	00			
		4			
Product.	26824	00			

2. Multiply 3467l. 16s. 8d. $\frac{1}{2}$	by 32.
5. Multiply 62lb. 10oz. 16dwt. 4gr.	by 42.
4. Multiply 3T. 13cwt. 2qr. 20lb. 10oz. 6dr	by 56.
5. Multiply 40yd. 2qr. 1n.	by 60.
6. Multiply 3deg. 50m. 7f. 36p.	by 72.

7 Multiply	£.	s.	d.	by	18.
	160	17	6 $\frac{1}{2}$		
			9		
	1447	17	10 $\frac{1}{2}$		
			2		
	£.	2895	15 9	Product.	

- | | |
|--|---------|
| 8. Multiply 43 <i>a</i> . 3 <i>r</i> . 36 <i>p</i> . | by 84. |
| 9. Multiply 30 <i>bar</i> . 1 <i>bus</i> . 3 <i>pk</i> . 1 <i>gal</i> . 2 <i>qt</i> | by 96. |
| 10. Multiply 31 <i>yr</i> . 9 <i>m</i> . 1 <i>w</i> . 6 <i>d</i> . | by 108. |
| 11. Multiply 7 <i>T</i> . 1 <i>bhd</i> . 30 <i>gal</i> . 2 <i>qr</i> . 1 <i>pt</i> . | by 120. |
| 12. Multiply 6 <i>sig</i> . 25 ^o 30 ['] 50 ["] | by 144. |

When no two factors in the table being multiplied together will make the multiplier, use those which will come the nearest thereto, then multiply the upper line by the deficiency, which added to the last product gives the answer; thus in the following example to multiply by 29, I multiply by 9 and 3, which make 27, and the upper line by 2, which added to the product of 27, gives the product of 29, &c.

	1.				
	£.	s.	d.		
Multiply	17	10	6½	by	29.
			9		
	157	14	10½		
			3		
	473	4	7½		
	35	1	1		
Product.	508	5	8½		

- | | |
|---|---------|
| 2. Multiply 1643 <i>dols</i> . 60 <i>cts</i> | by 37. |
| 3. Multiply 165 <i>l</i> . 16 <i>s</i> . 8 <i>d</i> . | by 46. |
| 4. Multiply 134 <i>l</i> . 12 <i>s</i> . 6 <i>d</i> . ½ | by 78. |
| 5. Multiply 153 <i>l</i> . 13 <i>s</i> . 3 <i>d</i> . ¾ | by 123. |
| 6. Multiply 147 <i>l</i> . 6 <i>s</i> . 4 <i>d</i> . ½ | by 152. |

Practical questions in Compound Multiplication.

- | | |
|---|---------------------|
| 1. 3 Knives at 50 cents each | Answer—\$ 1 50 cts. |
| 2. 5 Leghorn Bonnets at \$ 4 50 c. each | \$ 22 50 c. |
| 3. 10 Yards Muslin at 3 <i>dols</i> . 20 <i>c</i> . each | \$ 32 |
| 4. 11 Yards Cloth at 2 <i>dols</i> . 25 <i>cts</i> . each | \$ 24 75 c. |
| 5. 12 lbs. Pepper at 50 cts. per pound | \$ 6 |
| | <i>s. d.</i> |
| 6. 5 Yards cloth at 4/6 per yard | £. s. d. |
| 7. 6 ——— linen at 7/5½ per yd. | 1 2 6 |
| 8. 7 Pair shoes at 7/8½ per pair | 2 4 9 |
| 9. 8 Yards India Cotton at 2/6 per yard | 2 13 11½ |
| 10. 9 Mens Hats at 50/6 each | 1 0 0 |
| | 22 14 6 |

	£.	s.	d.
11. 10 Yards Tambored Muslin at $6\frac{1}{8}$ per yd.	3	6	8
12. 11 lb. Imperial Tea at $18\frac{1}{6}$ per lb.	10	3	6
13. 12 Saddles at $7\frac{2}{3}$ each	43	7	
14. 15 Yards Cloth at $6\frac{1}{6}$ per yard	4	17	6
15. 25 lbs. Tea at $10\frac{1}{6}$ per lb.	13	2	6
16. 36 Knives at $2\frac{1}{7}\frac{1}{2}$ each	4	14	6
17. 54 Pair Hofs at $10\frac{1}{6}$ per pair	28	7	0
18. 72 Yards Casimere at $15\frac{1}{6}$ per yd.	55	16	0
19. $80\frac{1}{2}$ Yards Thickfett at $7\frac{1}{6}\frac{1}{2}$ per yd.	30	7	$1\frac{1}{4}$
20. 92 Yards Cloth at $42\frac{1}{2}$ per yd.	193	4	0
21. $96\frac{1}{2}$ Yards Cloth at $25\frac{1}{2}$ per yd.	120	18	9
22. 125 Womens Saddles at $120\frac{1}{2}$ each	750	0	0
23. $145\frac{1}{4}$ Yards Broad Cloth at $36\frac{1}{2}$ per yd.	261	9	0
24. $150\frac{1}{2}$ lbs. Coffee at $1\frac{1}{10}\frac{1}{2}$ per lb.	14	2	$2\frac{1}{4}$
25. $120\frac{1}{2}$ Yards Muslin at $29\frac{1}{6}$ per yd.	177	14	9
26. $209\frac{1}{2}$ lbs. Indigo at $5\frac{1}{9}\frac{1}{2}$ per lb.	60	14	$9\frac{1}{2}$
27. $405\frac{1}{2}$ Gallons Brandy at $3\frac{1}{9}$ per gal.	76	1	$6\frac{1}{2}$
28. 610 Gallons Rum at $7\frac{1}{6}\frac{1}{2}$ per gal.	230	0	5
29. 1400 lbs. of tobacco at $37\frac{1}{6}$ per 100lb.	26	5	0
30. 7 Thousand pounds of Pork at $39\frac{1}{6}$ per 100lb.	138	5	0
31. 1 Barrel of Corn at $3\frac{1}{9}$ per bus.		18	9
32. 11 dozen Knives at $1\frac{1}{3}\frac{1}{2}$ each	8	13	3
33. 240 Yards Muslin at $14\frac{1}{6}$ per yd.	174	0	0
34. If a persons income be $7\frac{1}{6}$ per day, how much is that a year?	136	17	6
35. Sold 1344 lbs. of Coffee at $18\frac{1}{2}$ per pound, how much does it come to?	100	16	0
36. Bought 672 lbs of Tobacco at $7\frac{1}{2}$ per pound; what does it come to?	21	0	0

Compound Division.

COMPOUND DIVISION is the separating compound quantities into any proposed number of equal parts.

GENERAL RULE—Begin at the highest denomination as in Simple Division, and if any thing remains find how many of the next lower denomination this remainder is equal to, which add to the next denomination, then divide again, noting the quotient, and carrying the remainder (if any) as before, and so on till the whole be divided.

PROOF. Multiply the quotient by the divisor, when right, it will produce the dividend.

Examples.

$$\begin{array}{r}
 \text{1.} \quad \begin{array}{r} \text{8} \quad \text{c.} \\ 2 \overline{)16076} \quad 76 \\ \underline{8038} \quad 38 \text{ Answer.} \\ \quad \quad \quad 2 \\ \underline{16076} \quad 76 \text{ Proof.} \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{2.} \quad \begin{array}{r} \text{f.} \quad \text{s.} \quad \text{d.} \\ 4 \overline{)14376} \quad 16 \quad 8\frac{1}{4} \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{3.} \quad \begin{array}{r} \text{T. cwt. gr. lb.} \\ 6 \overline{)80} \quad 13 \quad 1 \quad 26 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{4.} \quad \begin{array}{r} \text{yds. gr. na.} \\ 8 \overline{)1684} \quad 3 \quad 2 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{5.} \quad \begin{array}{r} \text{4} \quad \text{r.} \quad \text{p.} \\ 10 \overline{)2764} \quad 3 \quad 22 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{6.} \quad \begin{array}{r} \text{f.} \quad \text{s.} \quad \text{d.} \\ 3 \overline{)787} \quad 14 \quad 8\frac{1}{2} \\ \underline{262} \quad 11 \quad 6\frac{1}{2} \quad \frac{1}{3} \text{ An.} \\ \quad \quad \quad 3 \\ \underline{787} \quad 14 \quad 8\frac{1}{2} \text{ Proof.} \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{7.} \quad \begin{array}{r} \text{lb. oz. dwt. grs.} \\ 5 \overline{)46} \quad 10 \quad 16 \quad 21 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{8.} \quad \begin{array}{r} \text{lb. oz. dr. sc. gr.} \\ 7 \overline{)15} \quad 10 \quad 6 \quad 1 \quad 18 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{9.} \quad \begin{array}{r} \text{deg. m. fur. p.} \\ 9 \overline{)36} \quad 46 \quad 6 \quad 38 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{10.} \quad \begin{array}{r} \text{bar. bus. pk. gal. qt.} \\ 11 \overline{)164} \quad 3 \quad 2 \quad 1 \quad 3 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{11.} \quad \begin{array}{r} \text{T. bb. gal. qt. pt.} \\ 12 \overline{)49} \quad 3 \quad 41 \quad 2 \quad 1 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{12.} \quad \begin{array}{r} \text{sig.} \quad \text{c} \quad \text{d} \quad \text{e} \\ 8 \overline{)10} \quad 20 \quad 46 \quad 58 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{13.} \quad \begin{array}{r} \text{yr. m. w. d. b.} \\ 9 \overline{)16} \quad 10 \quad 3 \quad 4 \quad 16 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{14.} \quad \begin{array}{r} \text{f.} \quad \text{s.} \quad \text{d.} \\ 7 \overline{)1642} \quad 16 \quad 7\frac{1}{2} \end{array}
 \end{array}$$

COMPOUND DIVISION.

When the divisor exceeds 12, try whether there are any two factors in the multiplication table, which, being multiplied, will make the divisor; then divide by one of those numbers, and that quotient by the other, the last quotient is the answer.

PROOF. Multiply the answer in the same order in which it was divided—the original dividend will occur when the work is right.

Examples.

2. Divide $\begin{matrix} \text{£} & \text{s.} \\ 1565 & 61 \end{matrix}$ among 15 men.

$$\begin{array}{r}
 \begin{array}{r} \text{£} \quad \text{s.} \\ 3 \overline{) 1565 \ 61} \\ \underline{5 \ 521} \quad 87 \\ 104 \ 37 \frac{2}{3} \end{array} \\
 \text{Answer.} \\
 \begin{array}{r} \text{£} \\ \underline{5} \\ 521 \ 87 \\ \underline{3} \\ 1565 \ 61 \end{array} \\
 \text{Proof.}
 \end{array}$$

2. Divide $\begin{matrix} \text{£} & \text{s.} & \text{d.} \\ 33324 & 18 & 11 \frac{1}{4} \end{matrix}$ by 33.

$$\begin{array}{r}
 \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 11 \overline{) 33324 \ 18 \ 11 \frac{1}{4}} \\ \underline{3 \ 3029} \quad 10 \ 9 \ \frac{2}{4} \\ 1009 \ 16 \ 11 \ \frac{1}{4} \\ \underline{3} \\ 3029 \ 10 \ 9 \ \frac{2}{4} \\ \underline{11} \\ 33324 \ 18 \ 11 \frac{1}{4} \end{array} \\
 \text{Answer.} \\
 \text{Proof.}
 \end{array}$$

3. Divide 666*l.* 17*s.* 8*d.* $\frac{2}{3}$ by 35. *Ans.* 19*l.* 1*s.* 0*d.* $\frac{3}{4}$ $\frac{1}{2}$
 4. Divide 1767*l.* 17*s.* 6*d.* by 60. *Ans.* 29*l.* 9*s.* 3*d.* $\frac{2}{3}$

Proof. Multiply the answer by the divisor, adding the value of the remainder, the product will be the dividend when the work is right.

Examples.

34)69355 (203|9
68

135
102

335
306

29
12

$$\overline{34)348} \begin{matrix} d. \\ 10 \end{matrix}$$

34

8 Remainder,

34) 3467 15 (£. s. d.
101 19 10

34

67

34

Abstract

33

20

34)675(19

34

335

306

29

15

34)34 8(10

34

8

COMPOUND DIVISION.

2.

Divide $\begin{matrix} \text{£.} & \text{s.} & \text{d.} \\ 48964 & 14 & 7 \end{matrix}$ among 41000 persons.

$ \begin{array}{r} 979294 \\ \underline{\hspace{1cm}} \\ 11751535 \\ \underline{\hspace{1cm}} \\ 41000 \overline{) 47006140} \quad (\\ \underline{41000} \\ 60061 \\ \underline{41000} \\ 190614 \\ \underline{164000} \\ 266140 \\ \underline{246000} \\ \text{Rem. } 20140 \end{array} $	$ \begin{array}{r} 4 \overline{) 1146} \\ 12 \overline{) 286} \frac{1}{2} \\ 2 \overline{) 0} 2 \frac{3}{10} \\ \hline \text{£. } 1 \ 3 \ 10 \frac{1}{2} \text{ Answer.} \\ \underline{20} \\ 23 \\ \underline{12} \\ 28 \ 6 \\ \underline{4} \\ 1146 \\ \underline{41000} \\ 1146000 \\ \underline{4584} \\ 46986000 \\ \underline{20140} \text{ Remainder.} \\ 4 \overline{) 47006140} \\ 12 \overline{) 11751535} \\ 2 \overline{) 0} 97929 \overline{) 4} - 7 \\ \hline \text{£. } 48964 \ 14 \ 7 \text{ Proof.} \end{array} $
---	--

3. Divide 142*l.* 16*s.* among 43 men—*Ans.* 3*l.* 6*s.* 5*d.* $\frac{1}{4}$

4. Divid $\acute{e}$ 16700*l.* 10*s.* 6*d* among 3100 men.

Answer—53*l.* 17*s.* 5*d.* $\frac{226}{3100}$

5. Divide 46l. 17s. 4d. among 74 men.—*Ans.* ol. 12s. 8d.

6. Divide 31ol. 12s. 0d. $\frac{1}{2}$ among 106 men.

Answer—2l. 18s. 7d. $\frac{1}{2}$

Practical questions in Compound Division.

1. If 6 yards Linen cost 2l. 10s. 3d. what is the value of one yard? *Answer*—ol. 8s. 4d. $\frac{1}{2}$

2. If 45 yards Muffin cost 2ol. 16s. 3d. what is the price per yard? *Answer*—ol. 9s. 3d.

3. Divide 75ol. among 64 men, and shew their respective parts on an equal division? *Answer*—11l. 14s. 4d. $\frac{1}{2}$

4. If 1200 gallons Molasses cost 300 dollars, what is that per gallon? *Answer*—25 cents.

5. If you sell 200 barrels of Corn for 350 dollars, what do you get per barrel? *Answer*—\$10 75c.

6. If you purchase 120 bushels of Wheat for 44l. 2s. 6d. what do you pay per bushel? *Answer*—ol. 7s. 4d. $\frac{1}{2}$

7. If 6 dozen Hats cost 189l. 18s. what is that for each? *Answer*—2l. 12s. 9d.

8. Divide 4257l. 10s. 6d. among 12 legatees.

Answer—354l. 15s. 10d. $\frac{1}{2}$

9. If a hoghead Tobacco weighing 1564lbs. cost 34l. 6s. 6d. what is the value of one pound? *Answer*—ol. 0s. 5d. $\frac{1}{4}$

10. If 1108ol. 14s. 7d. be divided among 18500 men, how much will each have? *Answer*—ol. 11s. 11d. $\frac{1}{4}$

11. If 1 ton of Iron cost 56l. what is the value of 1 pound? *Answer*—ol. 0s. 6d.

12. If 33 bales India Cotton, each bale 87 yards, cost 89l. 13s. 0d. $\frac{1}{2}$ what does one yard cost? *Answer*—ol. 0s. 7d. $\frac{1}{2}$

Division Crops, Prizes, and Partnerships.

DIVISION OF CROPS, &c. &c. teaches to divide any kind of produce, profits or losses of partnerships, &c. where the shares have either a whole, a part, or a whole and part of a share.

RULE. Set down the several shares, one under another, add them together, reduce them to the lowest denomination mentioned, make this number the divisor, and the given sum or quantity the dividend—after dividing the given sum, &c. multiply the quotient by the part of each shares, but observe that such part be reduced into the same denomination with

DIVISION OF PRIZES.

the divisor—and lastly, add the several shares thus found together; when the work is right, they will exactly produce the original dividend, or first given sum, which is the proof required.

Crops.

1.

Divide 4550lbs. of Tobacco among an overlooker and 7 hands, giving the overlooker $1\frac{1}{2}$ shares, the hands a share each.

$1\frac{1}{2}$	35	4550	(— 130	$1\frac{1}{2}$
7	35		7	$\frac{1}{4}$
$8\frac{1}{2}$	105		910	7 lbs. the Overseers part.
4	105			
35	0		130	4
			4	7
			520	28
			7	
			3640	lbs. the 7 hands ditto.
			910	
			4550	Proof.

2. Divide 575 barrels of Corn between an overseer and 5 hands, and allow the overseer $1\frac{1}{4}$ shares, the hands a share each.

Answer. $\left\{ \begin{array}{l} 152 \text{ bar. } \frac{1}{4} \\ 422 \frac{2}{4} \end{array} \right.$ Overseers part.
The hands ditto.

Division of Prizes.

1. Divide \$225 50 cents among a Captain and two Lieutenants, and give the Captain $2\frac{1}{2}$ shares, the Lieutenants a share each, and shew their respective parts.

DIVISION OF PARTNERSHIPS.

47

$$\begin{array}{r}
 \begin{array}{r}
 9 \overline{) 25550} \\
 \underline{1838} \\
 7170 \\
 \underline{5677} \\
 14920 \\
 \underline{14194} \\
 7260 \\
 \underline{7260} \\
 0
 \end{array}
 \end{array}$$

$\frac{1}{10}$ } 2838 $\frac{8}{10}$ } 1
 $\frac{1}{10}$ } 2
 $\frac{1}{10}$ } 5
 $\frac{1}{10}$ } 5677 $\frac{8}{10}$ } 2
 $\frac{1}{10}$ } 14194 $\frac{8}{10}$ } 2
 $\frac{1}{10}$ } 7260
 $\frac{1}{10}$ } 7260
 $\frac{1}{10}$ } 0

The Captains part. 1st. Lieutenants part.
 2d. Do. do.
 Proof.

2. The Captain of an armed schooner with 12 men took a prize worth \$4874 80 cents, of which the captain had $\frac{4}{7}$ shares of the money, one of the men $\frac{1}{7}$ shares, and the others a share each—divide the prize accordingly.

$$\begin{array}{r}
 \text{Answer's } \left\{ \begin{array}{l}
 \text{The Captains part} \quad \$ \quad 1296 \quad 38 \frac{2}{7} \\
 \text{The best man's part} \quad 430 \quad 12 \frac{1}{7} \\
 \text{The 11 mens do.} \quad 3154 \quad 28 \frac{1}{7}
 \end{array} \right.
 \end{array}$$

Division of Partnerships.

1. Three merchants joined in partnership, and on settling found they had sunk £. 750 of which A. had to pay $1\frac{2}{7}$ B. $1\frac{1}{7}$ and C. $\frac{1}{7}$ of a share—shew what each had to pay?

$$\begin{array}{r}
 \begin{array}{r}
 \text{A. } 1\frac{2}{7} \\
 \text{B. } 1\frac{1}{7} \\
 \text{C. } \frac{1}{7} \\
 \hline
 2\frac{4}{7} \\
 7 \\
 \hline
 18
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 2 \overline{) 750} \\
 \underline{375} \\
 375 \\
 \underline{333} \\
 41 \\
 \underline{41} \\
 0
 \end{array}$$

$$\begin{array}{r}
 9 \overline{) 375} \\
 \underline{333} \\
 41 \\
 \underline{41} \\
 0
 \end{array}$$

$$\begin{array}{r}
 41 \quad 13 \quad 4 \quad \left. \vphantom{\begin{array}{c} 41 \\ 13 \\ 4 \end{array}} \right\} 1\frac{2}{7} \\
 \underline{333} \quad 6 \quad 8 \quad \left. \vphantom{\begin{array}{c} 333 \\ 6 \\ 8 \end{array}} \right\} 1\frac{1}{7} \\
 333 \quad 6 \quad 8 \quad \left. \vphantom{\begin{array}{c} 333 \\ 6 \\ 8 \end{array}} \right\} \frac{1}{7}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{l}
 \text{£. } 375 \quad 0 \quad 0 \quad \text{A. had to pay.} \\
 \text{£. } 333 \quad 6 \quad 8 \quad \text{B. do.} \\
 \text{£. } 41 \quad 13 \quad 4 \quad \text{C. do.}
 \end{array}
 \end{array}$$

Answers:

750 0 0 Proof.

DIVISION OF CROPS, &c.

2. Messrs. E. F. & G. joined in partnership, and continuing 7 years in trade, came to a settlement of their accounts, found they had gained 8587 dollars 50 cents, of which E. was to have $2\frac{1}{2}$ shares, F. $1\frac{1}{2}$, and G. 1 share; divide the profits among them accordingly?

$$\text{Answers. } \begin{array}{r} \text{\$} \quad \text{c.} \\ \left\{ \begin{array}{l} \text{E. } 3935 \quad 93\frac{1}{4} \\ \text{F. } 2862 \quad 50 \\ \text{G. } 1789 \quad 06\frac{1}{4} \end{array} \right. \end{array}$$

Practical questions in the division of Crops, Prizes, &c.

1. An overlooker with 9 hands made 7349lbs. of Tobacco and 425 barrels of Corn, of which the overlooker was to have $1\frac{1}{2}$ of a share, and one of the hands superiour to the rest $1\frac{1}{4}$ of a share, the others a share each; I demand a division of the said crop.

$$\begin{array}{r} \text{lbs.} \\ \text{Answer. } \left\{ \begin{array}{l} \text{Overlooker} \quad 1168\frac{3}{4} \\ \text{Superiour hand} \quad 834\frac{29}{32} \\ \text{8 hands} \quad 5341\frac{13}{16} \end{array} \right\} \text{Tobacco.} \\ \text{bar.} \\ \left\{ \begin{array}{l} \text{Overlooker} \quad 67\frac{27}{32} \\ \text{Superiour hand} \quad 48\frac{13}{16} \\ \text{8 hands} \quad 309\frac{1}{4} \end{array} \right\} \text{Corn.} \end{array}$$

2. If the armed ship Constellation with a Captain, Lieutenant, Mate, and 28 men take a British prize worth 194640l. 18s. and it should be agreed that the Captain should have 5 shares, the Lieutenant 3, the Mate 2, and the men a share each; what will be their several shares?

$$\text{Answer. } \begin{array}{r} \text{\textit{l.}} \quad \text{\textit{s.}} \quad \text{\textit{d.}} \\ \left\{ \begin{array}{l} \text{Captain} \quad 25610 \quad 12 \quad 10\frac{1}{2} \quad 36 \\ \text{Lieutenant} \quad 15366 \quad 7 \quad 8\frac{3}{4} \quad 14 \\ \text{Mates} \quad 10244 \quad 5 \quad 1\frac{1}{4} \quad 22 \\ \text{28 Mens} \quad 143419 \quad 12 \quad 2\frac{1}{2} \quad 38 \end{array} \right. \end{array}$$

3. Seven in company made a shipment to Jamaica, by which they cleared 84 thousand pounds—the first had $4\frac{1}{2}$ of a share, 2d. 4 shares, 3d. $3\frac{1}{2}$ of a share, 4th. $3\frac{1}{2}$, 5th. $1\frac{1}{2}$, and the 6th. and 7th. one share each; what did each man have?

		£.	s.	d.	
<i>Answer.</i> {	1st. Man	17060	10	6 $\frac{1}{2}$	$\frac{80}{100}$ ($\frac{80}{100}$)
	2nd. do.	17684	4	2 $\frac{1}{2}$	$\frac{13}{100}$
	3d. do.	17407	17	10 $\frac{1}{2}$	$\frac{134}{100}$
	4th. do.	13815	15	9 $\frac{1}{2}$	$\frac{172}{100}$
	5th. do.	8289	9	5 $\frac{1}{2}$	$\frac{224}{100}$
	6 & 7th. do.	8842	2	7 $\frac{1}{2}$	$\frac{76}{100}$

Reduction.

REDUCTION is the changing a sum or quantity from a given denomination to another, retaining the same value—observing, that great names are brought into small by multiplication, and small names into great by division, viz. If it is required to change dollars into cents, dollars will be the great, and cents the small name; but if it is required to bring cents into dollars, the dollars will be the great name, and cents the small.

Reduction United States Money.

TO REDUCE DOLLARS INTO CENTS.

RULE. Add two ciphers to the right of the sum given in dollars, which is the same as multiplying by 100.

TO CHANGE CENTS INTO DOLLARS.

RULE. Dot off two figures to the right of the sum given in cents, the sum on the left will be dollars, on the right cents, the same as dividing by 100.

<i>Mills.</i>	<i>Cents.</i>	<i>Dimes.</i>	<i>Dols.</i>	<i>Eagles.</i>
10 ==	1 ==	$\frac{1}{10}$ ==	$\frac{1}{100}$ ==	$\frac{1}{1000}$
100 ==	10 ==	$\frac{1}{10}$ ==	$\frac{1}{10}$ ==	$\frac{1}{100}$
1000 ==	100 ==	100 ==	1 ==	$\frac{1}{10}$
10000 ==	1000 ==	1000 ==	10 ==	1

REDUCTION.

Examples.

1. Change 4716 dollars into cents. *Answer* 471600.
2. Change 4716 cents into dollars — \$47 16 cents.
3. Change 33454 dollars into cents.
4. Change 3345400 cents into dollars.
5. Change 760 eagles into cents. *Answer.* 760000.
6. Change 760000 cents into eagles. — 760.
7. Change 6000 mills into dimes. — 60.
8. In 298 7d. 3c. how many cents? — 2973.
9. In 4268 8d. 4c. 7m. how many mills? — 426847.
10. In 34ca. 48 ad. 4c. 4m. how many mills? — 344444.
11. Change 2973 cents into dollars. — 298 73 cts.
12. In 344444 mills, how many eagles, dollars, &c.
Answer—34ca. 48 ad. 4c. 4m.

Reduction Currencies, &c.

A dollar is composed of an equal number of cents in all countries, but as the dollar varies in nominal value, when counted in shillings and pence, the following table should be committed to memory.

TABLE.

In the States of New-York and North-Carolina, a dollar passes for	8s.
New-Jersey, Pennsylvania, Delaware, Mary- land and Ohio,	7½s.
New-Hampshire, Massachusetts, Rhode Island, Virginia, Connecticut, Kentucky and Ten- nessee,	6s.
South-Carolina and Georgia,	4½s.
Canada and Nova Scotia,	5s.
Ireland,	4½s.
England (<i>Sterling</i>)	4s.

General rule by which one currency may be changed into another.

RULE. Bring the dollars of each currency into one denomination, then multiply by the dollar of the currency which you wish to find, and divide by the dollar of the known currency.

PROOF as in compound division.

REDUCTION.

51

Examples.

1. Reduce 500l. 10s. 6d. New York currency into Virginia currency.

$$\begin{array}{r}
 500 \text{ lb } 6 \\
 6 \\
 \hline
 8 \overline{) 3003 \text{ } 3 \text{ } 0} \\
 \hline
 \text{£. } 375 \text{ } 7 \text{ } 10\frac{1}{2} \text{ } \text{Answer.} \\
 8 \\
 \hline
 6 \overline{) 3003 \text{ } 3 \text{ } 0} \\
 \hline
 500 \text{ } 10 \text{ } 6 \text{ } \text{Proof.}
 \end{array}$$

2. Change £375 7s 10d $\frac{1}{2}$ Virginia currency into the currency of New-York.

$$\begin{array}{r}
 375 \text{ } 7 \text{ } 10\frac{1}{2} \\
 8 \\
 \hline
 6 \overline{) 3003 \text{ } 3 \text{ } 0} \\
 \hline
 \text{£ } 500 \text{ } 10 \text{ } 6 \text{ } \text{Answer.}
 \end{array}$$

NOTE—In the two preceding examples the dollars of both currencies are of the same denomination, both consisting of shillings without odd pence. I therefore in first multiply by 6, the shillings in Virginia currency, and divide by 8, the shillings in the New York currency; and in the second I multiply by 8 and divide by 6, according to the rule given.

3. Change £250 10s. 6d. South Carolina money, into Pennsylvania currency.

$$\begin{array}{r}
 250 \text{ } 10 \text{ } 6 \\
 10 \\
 \hline
 2505 \text{ } 5 \text{ } 0 \\
 9 \text{ } 90 \text{ pence in a dol. Pennsylvania.} \\
 \hline
 \text{56 pence to a dol. } \left. \begin{array}{l} \text{South Carolina.} \end{array} \right\} 8 \overline{) 22547 \text{ } 5 \text{ } 0} \\
 \hline
 7 \overline{) 2818 \text{ } 8 \text{ } 1\frac{1}{2}} \\
 \hline
 \text{£ } 402 \text{ } 12 \text{ } 7 \text{ } \text{Answer.}
 \end{array}$$

NOTE—In this example, there being odd pence, the dollar of both currencies are reduced to pence, to bring them into one denomination; I therefore multiply by 90, the pence in the Pennsylvania currency, and divide by 56, the pence in the South Carolina currency.

REDUCTION.

Showing the Value of all the United States Coins in all the State Currencies, Sterling, &c.

A TABLE

[illegible]

1. A TABLE of Cents, answering in value to the pound, shilling and penny, of all the American and other currencies, English Sterling, &c.

	6s. to the Dollar.	8s. to the Dollar.	7s. 6d. to the Dollar.	4s. 8d. to the Dollar.	5s. to the Dollar.	4s. 6d. to the Dollar.	4s. 10d. to the Dollar.
Pound.	333 $\frac{1}{3}$	250	266 $\frac{2}{3}$	428 $\frac{2}{3}$	400	444 $\frac{2}{3}$	410 $\frac{1}{3}$
Shilling.	16 $\frac{2}{3}$	12 $\frac{1}{2}$	13 $\frac{1}{3}$	21 $\frac{1}{3}$	20	22 $\frac{2}{3}$	20 $\frac{2}{3}$
Penny.	1 $\frac{1}{3}$	1 $\frac{1}{4}$	1 $\frac{1}{5}$	1 $\frac{1}{4}$	1 $\frac{1}{5}$	1 $\frac{1}{4}$	1 $\frac{1}{5}$

2. THE following Table, which is the same in substance with the above, will be found easier and shorter in the operation and practice of the sums.

	CENTS. 1000	CENTS. 100	CENTS. 10	CENTS. 1	CENTS. 100	CENTS. 10	CENTS. 1	CENTS. 1000
Pound	1000	100	10	1	1000	100	10	1000
Shilling	100	10	1	1	100	10	1	100
Penny.	10	1	1	1	10	1	1	10

3. NOTE.—If pounds and dollars only are used, the following Table of dollars will be shorter in the operation than the above Table of cents.

	6s.	8s.	4s. 6d.	4s. 8d.	5s. 6d.	4s. 6d.	4s. 10d.
Pound	Dols. 1 $\frac{1}{3}$	Dols. 1 $\frac{2}{3}$	Dols. 1 $\frac{1}{2}$	Dols. 1 $\frac{1}{4}$	Dols. 1 $\frac{1}{5}$	Dols. 1 $\frac{1}{6}$	Dols. 1 $\frac{1}{8}$

REDUCTION.

To change currencies Sterling, &c. into United States money.

1. Consider how many shillings make a dollar of the currency, then in the column under that currency opposite the word pound, (if the currency is in pounds, or opposite shillings, if in shillings, &c. you will find the cents answerable to it at top, and below the fractions expressed thus, $\frac{1000}{3}$, $2\frac{5}{12}$, $3\frac{1}{4}$, &c. &c. in the preceding table. (page 53.)

RULE. Multiply the given currency by the upper figure or figures of such fraction, and divide the product by the under, the quotient will be the answer in cents; dot off two right hand figures for cents, those on the left will be dollars.

Change 327l. 16s. 6d. Virginia currency into Dollars.

NOTE. This currency has 6s. to the dollar, (see table 2, page 53) and as these are odd pence in the question, the whole sum must be reduced into pence, and the rule opposite the word penny, under 6s. to the dollar, stands $2\frac{5}{12}$.

OPERATION.

	1.	
£.	s.	d.
327	16	6
20		
6556		
12		
78678	Pence:	
25	Upper figures of the fraction.	
393390		
157356		

Under 18) 1066950 (109275 cts. or 1092 dols. 75 cts. *Ans.*

Figures. 18

166	
162	
49	
36	
135	
126	
90	
90	

General rule, which requires no assistance from tables.

Bring the currency into the lowest denomination mentioned, either in the question or in the value of a dollar, then divide by as many of that denomination as make a dollar.

1. Change 327l. 16s. 6d. Virginia currency into dollars.

$$\begin{array}{r}
 20 \\
 \hline
 6556 \\
 12 \\
 \hline
 72 \overline{) 78678} (1092 \frac{3}{4} \text{ Answer.} \\
 \underline{72} \\
 667 \\
 \underline{648} \\
 198 \\
 \underline{144} \\
 54 \\
 \underline{72} \div \frac{3}{4}
 \end{array}$$

The remainder 54 in this operation may be reduced into cents by observing table 2d. page 53—against the word penny, and under 6s. to the dollar, the fractional part will stand thus, $\frac{3}{4}$. By multiplying by the upper, and dividing by the lower figures of the same.

Viz.

$$\begin{array}{r}
 54 \\
 25 \checkmark \\
 \hline
 270 \\
 108 \\
 \hline
 18 \overline{) 1350} (75 \text{ cents.} \\
 \underline{126} \\
 90 \\
 \underline{90}
 \end{array}$$

So that the remainder being valued in this way, the answer of the question will be 1092 dollars 75 cents agreeably with the preceding method in which it is performed.

2. Change 3757l. North Carolina currency to dollars.

$$\begin{array}{r}
 20 \\
 \hline
 8 \overline{) 75140}
 \end{array}$$

Dols. 9392 50 cents. *Answer.*

NOTE. Though there are only pounds in this question, it must be reduced to shillings, because the dollar in North Carolina contains 8s.

To change U. States Money into Currencies, &c.

1. Reduce the dollars into cents, and find the rule in the table, page 53.

Rule by the Table.

Multiply the cents by the under figure or figures of the fraction, and divide that product by the upper, the quotient will be the answer.—

Or by the General Rule: viz.

Separate the cents from the dollars by a dot, then multiply by the pence in a dollar; cut off as many figures to the right hand of the product as were separated for cents, then divide by 12 and 20, the quotient will be the currency.

Examples.

1. Change 1092 dollars 75 cents into Virginia currency.

$$\begin{array}{r}
 109275 \\
 \underline{3} \\
 11000 \overline{) 327825} \\
 \underline{327} \\
 825 \text{ Rem.} \\
 \underline{20} \\
 11000 \overline{) 16500} \\
 \underline{165} \\
 16s. 500 \text{ Rem.} \quad \text{Ans. } 327 \text{ l. } 16s. 6d. \\
 \underline{12} \\
 11000 \overline{) 6000} \\
 \underline{60} \\
 6d.
 \end{array}$$

REDUCTION.

57

OPERATION BY THE GENERAL RULE.

$$\begin{array}{r}
 1092.75 \\
 \underline{72} \text{ pence in a dollar.} \\
 218550 \\
 \underline{764925} \\
 12\ 178678\ 00 \\
 \underline{2\ 10\ 655\ 16.6} \\
 \hline
 \text{£. } 327\ 16\ 6 \text{ Answer.}
 \end{array}$$

2. Reduce 136l. 19s. 7d. South Carolina currency into dollars.
Answer—\$ 587 $5\frac{1}{4}$ cents.
3. Reduce 428 dollars 57 cents into New York currency.
Answer—171l. 8s. 6d. $\frac{1}{4}$ $\frac{2}{3}$.
4. Reduce 725l. 17s. 10d. Canada currency into dollars.
Answer—\$ 2903 $56\frac{2}{3}$ cents.
5. Reduce 2903 dollars 56 cents into Canada currency.
Answer—725l. 17s. 10d.
6. Change 1453l. 15s. 8d. Nova Scotia currency into dollars.
Answer—\$ 5815 $13\text{cts.}\frac{1}{4}$.
7. Reduce 2903 dollars 56 cents into Canada currency.
Answer—725l. 17s. 10d.
8. Reduce 327l. 16s. 6d. Kentucky currency into dollars.
Answer—\$ 1092 75cts.
9. Reduce 779l. 11s. 6d. sterling into dollars.
Answer—\$ 3464 77cents.
10. Reduce 970l. North Carolina currency into South Carolina currency.
Answer—565l. 16s. 8d.
11. Bring 60l. 12s. 4d. North Carolina into Virginia currency.
Answer—45l. 9s. 6d.
12. Change 28l. 15s. Maryland into New York currency.
Answer—30l. 13s. 4d.
13. Change 300l. 5s. Virginia into New York currency.
Answer—400l. 6s. 8d.
14. Change 900l. 10s. Virginia currency into sterling.
Answer—675l. 7s. 6d.
15. Change 1800l. Maryland currency into Nova Scotia currency.
Answer—1200l. 0s. 0d.
16. Change 792l. 19s. 7d. North Carolina currency into Pennsylvania currency.
Answer—743l. 8s. 4d. $\frac{1}{4}$.
17. Change 643l. 85s. 7d. New York currency into New Jersey currency.
Answer—603l. 10s. 10d. $\frac{1}{4}$ $\frac{2}{3}$.

REDUCTION.

18. Change 675*l*. sterling into Virginia currency.

Answer—900*l*.

19. Change 200*l*. New Jersey currency into that of New Hampshire.

Answer—160*l*.

20. Change 100*l*. Georgia currency into Virginia currency.

Answer—128*l*. 11*s*. 54*d*.

21. What is the value of 900*l*. Massachusetts money in South Carolina.

Answer—700*l*.

A TABLE by which sterling and other currencies may be changed into any proposed currency mentioned in a shorter way than the foregoing method, by observing the following :

RULE. Multiply the given currency by the upper figure, or figures of the fraction of the currency which you wish to find and divide the product by the lower figure, the quotient will be the value in the required currency.

NOTE.—To find the fractional parts, look in the table below for the rule of proportion for the state or country, whose money is to be changed against either, you will find the proportion expressed thus, 3-4ths, 4-5ths, &c.

To change the currencies of New-York, &c. or 8 <i>l</i> to the dollar, into					
N. Hampshire.	$\frac{3}{4}$	Canada.	$\frac{5}{8}$	Livres French.	$\frac{27}{100}$
New Jersey.	$\frac{1}{2}$	Irish.	$\frac{3}{4}$	Guilders Dutch.	$\frac{4}{100}$
S. Carolina.	$\frac{7}{8}$	English.	$\frac{9}{16}$	Dollars.	$\frac{3}{100}$
To change the currency of New-Hampshire, &c. or 6 <i>l</i> to the dollar into					
N. York.	$\frac{4}{5}$	Canada.	$\frac{3}{4}$	Livres.	$\frac{18}{100}$
N. Jersey.	$\frac{5}{6}$	Irish.	$\frac{1}{2}$	Guilders.	$\frac{60}{100}$
S. Carolina.	$\frac{7}{8}$	English.	$\frac{3}{4}$	Dollars.	$\frac{10}{100}$
To change the currency of New-Jersey, &c. or 7 <i>l</i> to the dollar, into					
N. Hampshire.	$\frac{4}{5}$	Canada.	$\frac{2}{3}$	Livres.	$\frac{72}{100}$
N. York.	$\frac{1}{2}$	Irish.	$\frac{1}{2}$	Guilders.	$\frac{48}{100}$
S. Carolina.	$\frac{2}{3}$	English.	$\frac{3}{4}$	Dollars.	$\frac{3}{100}$
To change South-Carolina, &c. or 4 <i>l</i> to the dollar, into					
N. Hampshire.	$\frac{5}{6}$	Canada.	$\frac{1}{2}$	Livres.	$\frac{62}{100}$
N. York.	$\frac{1}{2}$	Irish.	$\frac{1}{2}$	Guilders.	$\frac{50}{100}$
N. Jersey.	$\frac{4}{5}$	English.	$\frac{2}{3}$	Dollars.	$\frac{30}{100}$

To change Canada and Nova Scotia, or 5s to the dollar into

N. Hampshire	6	S. Carolina.	14	French Livres	108
New York	13	Irish.	39	Dutch Guilds.	72
New Jersey	13	English	40	Dollars.	74

To change Irish or 4s. 10½d to the dollar, into

N. Hampshire.	16	S. Carolina.	112	French Livres	228
New York.	16	Canada.	110	D. Guilders.	137
New Jersey.	16	English.	110	Dollars.	160

To change English Sterling, or 4s 6d. to the dollar, into

N. Hampshire	4	S. Carolina.	28	French Livres	24
New York.	10	Canada.	10	Dutch Guilds.	80
New Jersey.	10	Irish.	12	Dollars.	40

To change French Livres of 10d. Sterling into

N. Hampshire	1	S. Carolina.	5	Eng. Sterling.	1
New York.	18	Canada.	110	Dutch Guilds.	23
New Jersey.	18	Irish.	13	Dollars.	5

To change Dutch Guilders of 1s. 9d. Sterling into

N. Hampshire.	7	S. Carolina.	49	Eng. Sterling.	7
New York.	20	Canada.	340	French Livres	21
New Jersey.	20	Irish.	72	Dollars	10

To change dollars of 4s. 6d. Sterling into

N. Hampshire	3	S. Carolina.	7	Eng. Sterling.	9
New York.	10	Canada.	30	French Livres	20
New Jersey.	10	Irish.	39	Dutch Guilds.	18

NOTE.—The foregoing table is made by this general rule, viz: the numbers being reduced to their lowest denomination, for instance, the general rule for changing New-York into New-Hampshire is, multiply by 6 and divide by 8: the tabular rule is, multiply by 3 and divide by 4; the numbers 3 and 4 bearing the same proportion to each other as 6 and 8.

RULE 1.—Find in the last table the proportion for the state or country whose money you wish to change, opposite the state or country you will find the proportion expressed by a fraction, thus $\frac{3}{4}$.

REDUCTION.

2. Multiply the money you wish to change by the upper figure or figures of the fraction, and divide the product by the under; the quotient will be the answer.

Examples.

Change £. 800 6s. 8d, New-York into Virginia currency.

NOTE.—To work this sum, I examine the table and find the proportion to be 3-4. I therefore multiply by 3 and divide by 4.

$$\begin{array}{r} 1. \quad \text{Operation.} \quad 800 \quad 6 \quad 8 \\ \hline \phantom{1. \quad \text{Operation.} \quad} 3 \\ 4 \overline{) 2401 \quad 0 \quad 0} \end{array}$$

Ans. £. 600 5 0 Virginia currency.

2. Change £. 600 5s. 0d. Virginia into New-York currency.

NOTE.—I find the proportion in the table to be 4-3 and proceed in the multiplication and division of the sum as before.

$$\begin{array}{r} \text{£.} \quad \text{s.} \\ 600 \quad 5 \\ \hline 4 \\ 3 \overline{) 2401 \quad 0} \\ \hline \text{Ans. £. 800 6—8 N. York currency.} \end{array}$$

3. Change £. 900 10s. Virginia currency into sterling.

The proportion $\frac{3}{4} =$ *Ans. £. 675 7s. 6d.*

4. Change £. 200 10s. 6d. North-Carolina into Georgia currency.

The proportion $\frac{7}{8} =$ *Ans. £. 116 10s. 5½d.*

5. What is the value of £. 847 11s. 1½d. New-York currency in England.

The proportion $\frac{9}{10} =$ *Ans. £. 476 15s.*

6. Change £. 500 New-York currency into Irish money.

The proportion $\frac{3}{4} =$ *Ans. £. 304 13s. 9d.*

7. Change £. 750 Georgia currency into that of Rhode-Island.

The proportion $\frac{7}{8} =$ *Ans. £. 964 5s. 8½d. ¾*

8. Change 5060 Guilders into Livres French.

The proportion $\frac{3}{10} =$ *Ans. 10626 Livres.*

9. Change £.327 15s. Nova-Scotia into Virginia currency.
The proportion $\frac{6}{7} =$ *Ans.* £.393 6s.
10. Change £.1500 Virginia currency into dollars.
The proportion $\frac{10}{7} =$ *Ans.* \$5000
11. Change £.576 12s. South-Carolina into New-York currency.
The proportion $\frac{12}{7} =$ *Ans.* £.988 9s. 1½d. $\frac{6}{7}$
12. If you remit £.410 10s. 6d. Virginia currency to Ohio, what credit will you receive in that state?
The proportion $\frac{12}{7} =$ *Ans.* £.513 3s. 1½d.
13. Change £.476 15s. English into North Carolina money.
The proportion $\frac{10}{9} =$ *Ans.* £.847 11s. 1½d. $\frac{1}{3}$
14. Change £.500 16s. 6d. Canada into New-York currency.
The proportion $\frac{5}{4} =$ *Ans.* £.801 6s. 4¾d. $\frac{1}{2}$
15. Reduce £.640 10s. Canada currency into dollars.
The proportion $\frac{4}{3} =$ *Ans.* \$2562
16. Reduce £.980 sterling into dollars.
The proportion $\frac{40}{9} =$ *Ans.* \$4355½
17. Change £.650 16s. Tennessee currency into Pennsylvania currency.
The proportion $\frac{5}{4} =$ *Ans.* £.813 10s. 0
18. Change 10626 Livres French into Dutch Guilders.
The proportion $\frac{12}{11} =$ *Ans.* 5060 Guilders.
19. Change £.100 10s. 6d. Kentucky currency into Ohio currency?
Ans. £.125 13s. 1½d.
20. What is the value of £.750 Maryland currency in N. Carolina?
Ans. £.800
21. How much Tennessee currency will purchase a bill for £.280 South-Carolina currency?
Ans. £.360

*Reduction of Coins.**General Table of Coins with their value in sterling and American dollars.*

COINS.	Sterling Value.			American val.		Cents.
	£.	s.	d.	\$	Cts.	Cents.
Guinea English.	1	1	0	4	66 $\frac{2}{3}$	1400
Half Guinea.		10	6	2	33 $\frac{1}{3}$	700
Pound Sterling,	1	0	0	4	44 $\frac{2}{3}$	1000
Mark.		13	4	2	96 $\frac{2}{3}$	2000
Noble.		6	8	1	48 $\frac{4}{9}$	1000
Johannes.	3	12	0	16	00	1600
Half Johannes.	1	16	0	8	00	800
Moidore.	1	7	0	6	00	600
Crown En. or Fr.		5	0	1	11 $\frac{1}{8}$	1000
Half Crown.		2	6		55 $\frac{1}{8}$	500
Shilling English.		1	0		22 $\frac{1}{2}$	200
Six-pence do.		0	6		11 $\frac{1}{8}$	100
Penny do.		0	1		1 $\frac{1}{8}$	50
Dollar Am. & Spa.	4	6		1	00	100
Guilder Dutch.	1	9			38 $\frac{1}{8}$	250
Livre Tournais Fr.	0	10			11 $\frac{1}{17}$	220

NOTE.—Any of the above coins may be changed into United States money, by multiplying with the upper figures, and dividing by the lower in the last column: the product to be in cents.

TO CHANGE ONE COIN INTO ANOTHER.

GENERAL RULE.—Reduce the given coins into one denomination, and divide by the value of the coin which you wish to find.

REDUCTION.

83

Examples.

Change 475 Guineas into Moidores.

475
21 The shillings in a Guinea.

475
950

Shillings in a Moid. 27) 9975 (369 $\frac{1}{2}$ = 369 Moidores and 12 shillings over.

81
187
162

255
243

12

NOTE.—This operation, as well as many others in Reduction, may be often shortened, by dividing the multiplier and divisor by some number that will divide them both without a remainder—For instance, instead of multiplying by 21 and dividing by 27, as in the above example, I perceive that 3 will divide 21 and 27, without a remainder. I therefore use their quotients 7 and 9 instead of 21 and 27, as in the same example below.

475
7

9) 3325

369 $\frac{1}{2}$ Moidores.

The $\frac{1}{2}$ of a Moidore is equal to 12s. making the same answer as the one above.

2. Change £.560 sterling into half Guineas.

Ans. 1066 $\frac{2}{3}$ = $\frac{2}{3}$ Guineas.

3. Change 3530 Marks into Nobles.

Answer 7060 Nobles.

4. Change 7650 crowns into Johannes.

Answer 531 $\frac{1}{2}$ = Johannes.

5. Change £.563 sterling into dollars sterling.

Ans. 2502 $\frac{2}{3}$ Dollars.

6. Change £.640 sterling into Guilders.

Ans. 7314 $\frac{2}{3}$ Guilders.

7. Change 500 crowns into dollars sterling.

Answer 555 $\frac{1}{2}$ Dollars.

REDUCTION.

8. If £.546 Pennsylvania currency be exchanged for dollars, how many is equivalent? *Ans.* 1456 Dollars.

9. In 1800 Guilders how many Livres?

Answer 3780 Livres.

10. Reduce 640 half crowns into Livres.

Answer 1920 Livres.

11. Reduce 67320 Guilders into Dollars.

Answer 26180 dollars.

12. Reduce 637 Johannes into Guineas.

Answer 2184 Guineas.

Farthings.

$$\begin{array}{rclcl} 4 & = & 1 & \text{Penny.} & \\ 48 & = & 12 & = & 1 \text{ Shilling.} \\ 960 & = & 240 & = & 20 = 1 \text{ Pound.} \end{array}$$

1. Reduce £.360 to Pence.

$$\begin{array}{r} 360 \\ 20 \\ \hline 7200 \\ 12 \\ \hline \text{Answer—}86400 \end{array} \quad \begin{array}{r} d. \\ 12 \overline{)86400} \\ \hline 210 \overline{)720} \mid 0 \\ \hline \text{£.360 Proof.} \end{array}$$

Or thus:

$$\begin{array}{r} 360 \\ 240 \text{ Pence in a Pound.} \\ \hline 14400 \\ 720 \\ \hline \text{Answer—}86400 \end{array}$$

2. Bring £. 650 11 6½ into Farthings.

$$\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 650 \quad 11 \quad 6\frac{1}{2} \\ 20 \\ \hline 13011 \\ 12 \\ \hline 156138 \\ 4 \\ \hline \text{Farthings } 624554 \text{ Answer.} \end{array} \quad \begin{array}{r} 4 \overline{)624554} \\ \hline 12 \overline{)156138\frac{1}{2}} \\ \hline 210 \overline{)13011} \text{—}6 \\ \hline \text{£.650 11 6}\frac{1}{2} \text{ Proof.} \end{array}$$

3. Change £.46 into pence. *Ans.* 11040d.
4. Change £.90 17s. 6d. into two pences. *Ans.* 10905.
5. In 680 pence, how many pounds. *Ans.* £7
6. Change 44871 farthings into pounds. *Ans.* £.46 14s. 9½d.
7. Change 6431 sixpences into pounds. *Ans.* £.160 15s. 6d.
8. Reduce £.48 12s. 8d. into Groats at 4d. each. *Answer* 2918.
9. How many crowns are there in £.28. *Ans.* 112 crowns.
10. In forty Guineas of 28s. each, how many crowns and pounds? *Ans.* 224 crowns, £.56.
11. Change 612 half crowns into crowns and pence. *Ans.* 306 crowns, 18360 pence.
12. Change 12180 three pences into shillings and pence? *Ans.* 3045 shillings, 36540 pence.

If at any time it should be required to reduce any number of one coin into a variety of other coins, demanding an equal number of each, observe this RULE.

Set down the value of one of each the required coins one under another in proper order, add them together, and bring their sum into the same denomination with the given coin; divide the given coin by the sum of the required coins, the quotient will be the answer.

Examples.

1. How many crowns, half crowns, half guineas, pounds sterling and guineas, of each an equal number, are in 11800 dollars sterling?

OPERATION.

	£.	s.	d.
Crown	0	5	0
Half do.	0	2	6
Half Guinea	0	10	6
Pound Sterling	1	0	0
Guinea	1	1	0
	2	19	0
	20		
	59		
	2		
	118		

2 Sixpences in a shilling.

$$\begin{array}{r}
 11800 \\
 \underline{9 \text{ Sixpences in a dollar [sterling.]}} \\
 118)106200(900-\text{Answer.} \\
 \underline{1062} \\
 \dots 00 \\
 K
 \end{array}$$

REDUCTION.

2. In £.111 12s. 3d. how many pieces of 13 $\frac{1}{2}$ d. 12d. 9d. and 6d. and of each an equal number? *Ans.* 1254.

Troy Weight.

Grains.		Pen.		Ounces.		Pounds.
24	=	1	=	$\frac{1}{16}$	=	$\frac{1}{128}$
480	=	20	=	1	=	$\frac{1}{12}$
5760	=	240	=	12	=	1

Examples.

1. In 47lb. 10oz. how many grains? *Answer*—275520.
2. In 47128 grains, how many pounds, &c.
Answer—8lb. 2oz. 3dws. 16grs.
3. Reduce 275520 grains into pounds? *Answer*—47lb. 10oz.

Apothecaries Weight.

grs.		scr.		drs.		oz.		pounds.
20	=	1	=	$\frac{1}{3}$	=	$\frac{1}{24}$	=	$\frac{1}{288}$
60	=	3	=	1	=	$\frac{1}{8}$	=	$\frac{1}{96}$
480	=	24	=	8	=	1	=	$\frac{1}{12}$
5760	=	288	=	96	=	12	=	1

Examples.

1. Reduce 12lb. 1oz. 2drs. osc. 1gr. into grains.
Answer—69721.
2. In 69721 grains, how many pounds, &c.
Answer—12lb. 1oz. 2drs. osc. 1gr.
3. In 5lbs. of drugs, how many parcels each 16 drams?
Answer—30.

Averdupois Weight.

Drams.		Ounces.		Pounds.		Qrs.		Cwt.		Tuns.
16	=	1	=	$\frac{1}{16}$	=	$\frac{1}{4}$	=	$\frac{1}{1792}$	=	$\frac{1}{35840}$
256	=	16	=	1	=	$\frac{1}{16}$	=	$\frac{1}{112}$	=	$\frac{1}{2240}$
7168	=	448	=	28	=	1	=	$\frac{1}{4}$	=	$\frac{1}{16}$
28672	=	1792	=	112	=	4	=	1	=	$\frac{1}{16}$
573440	=	35840	=	2240	=	80	=	20	=	1

Examples.

1. In 284 tons 12 cwt. 3 grs. 18 lbs. 10 oz. 8 drs. how many drams? *Answer*—163227304.
2. In 3 tons of Iron, how many pounds? *Ans.* 6720.
3. In 6720 lb. of Iron, how many hundred weight? *Ans.* 60 cwt.

Cloth Measure.

<i>In.</i>		<i>Na.</i>		<i>Qr.</i>		<i>Yd.</i>
2 $\frac{1}{2}$	=	1	=	$\frac{1}{4}$	=	$\frac{1}{16}$
9	=	4	=	1	=	$\frac{1}{4}$
36	=	16	=	4	=	1

Examples.

1. In 700 nails of a yard, how many Ells English? *Answer*—35.
2. In 4 bales of cloth, each 12 pieces, and each piece 24 ells English, how many yards, and ells Flemish? *Answer*—1440 yds. 1920 ells Flemish.
3. In 15 yds. 3 grs. 2 nails, how many nails? *Ans.* 254.

Long Measure.

<i>Bar.</i>	<i>Cor.</i>	<i>Inches.</i>		<i>Feet.</i>		<i>Yds.</i>		<i>Poles.</i>		<i>Fur.</i>		<i>Miles.</i>
3	—	1	—	$\frac{1}{12}$	—	$\frac{1}{36}$	—	$\frac{1}{108}$	—	$\frac{1}{2160}$	—	$\frac{1}{63360}$
36	—	12	—	1	—	$\frac{1}{3}$	—	$\frac{1}{12}$	—	$\frac{1}{600}$	—	$\frac{1}{31680}$
108	—	36	—	3	—	1	—	$\frac{1}{4}$	—	$\frac{1}{240}$	—	$\frac{1}{17280}$
594	—	198	—	16 $\frac{1}{2}$	—	5 $\frac{1}{2}$	—	1	—	$\frac{1}{48}$	—	$\frac{1}{3456}$
23760	—	7920	—	660	—	220	—	40	—	1	—	$\frac{1}{16}$
190080	—	63360	—	5280	—	1760	—	320	—	8	—	1

Examples.

1. In 5 miles how many barley corns? *Answer*—950400.
2. Reduce 70 miles into yards. *Answer*—125200.
3. Reduce 2280060 barley corns to miles. *Answer*—11 m. 7 fur. 38 po. 2 yds. 2 feet.
4. How many revolutions will a wheel, 18 feet 4 inches, make, in running 150 miles? *Answer*—43200.
5. Required the earth's circumference in barley corns? *Answer*—4755801600.

REDUCTION.

Land Measure.

<i>sq. incb.</i>	<i>sq. feet.</i>	<i>sq. yd.</i>	<i>sq. pe.</i>	<i>rood.</i>	<i>acre.</i>
144 —	1 —	$\frac{1}{9}$ —	$\frac{1}{1600}$ —	$\frac{1}{1600}$ —	$\frac{1}{43560}$ —
1296 —	9 —	$\frac{1}{4}$ —	$\frac{1}{400}$ —	$\frac{1}{400}$ —	$\frac{1}{1210}$ —
39204 —	272 $\frac{1}{4}$ —	30 $\frac{1}{2}$ —	1 —	$\frac{1}{4}$ —	$\frac{1}{160}$ —
1568160 —	10890 —	1210 —	40 —	1 —	$\frac{1}{4}$ —
1272640 —	43560 —	4840 —	160 —	4 —	1 —

Examples.

1. Reduce 27 acres, 1 rood, 32 perches, into perches?
Answer—4392.
2. In 2850 perches how many acres. *Ans.*—17 a. 3 r. 10 pe.
3. In a plat of land 185 perches long and 35 broad, how many acres?
Answer—40 a. 1 r. 35 pe.

Dry Measure.

<i>pt.</i>	<i>qt.</i>	<i>pec.</i>	<i>bus.</i>
2 —	1 —	$\frac{1}{4}$ —	$\frac{1}{32}$ —
8 —	4 —	$\frac{1}{2}$ —	$\frac{1}{8}$ —
16 —	8 —	1 —	$\frac{1}{4}$ —
64 —	32 —	4 —	1 —

Examples.

1. In 40 barrels, how many pecks? *Answer*—800.
2. In 4000 pints, how many bushels? *Ans.* 62 bus. 2 pints.

Liquid Measure.

<i>Pints.</i>	<i>gal.</i>	<i>tie.</i>	<i>bbd.</i>	<i>pun.</i>	<i>p. or b.</i>	<i>tuns.</i>
8 = 1	$\frac{1}{4}$ —	$\frac{1}{63}$ —	$\frac{1}{84}$ —	$\frac{1}{24}$ —	$\frac{1}{128}$ —	$\frac{1}{256}$ —
336 = 42	1 —	$\frac{2}{3}$ —	$\frac{1}{2}$ —	$\frac{1}{3}$ —	$\frac{1}{6}$ —	$\frac{1}{6}$ —
504 = 63	1 $\frac{1}{2}$ —	1 —	$\frac{3}{4}$ —	$\frac{1}{2}$ —	$\frac{1}{4}$ —	$\frac{1}{4}$ —
672 = 84	2 —	1 $\frac{1}{2}$ —	1 —	$\frac{2}{3}$ —	$\frac{1}{3}$ —	$\frac{1}{3}$ —
1008 = 126	3 —	2 —	1 $\frac{1}{2}$ —	1 —	$\frac{1}{2}$ —	$\frac{1}{2}$ —
2010 = 252	6 —	4 —	3 —	2 —	1 —	1 —

Examples.

1. In 19 hhds. of rum, how many pints? *Ans.* 9576.
2. Reduce 9576 pints to hhds. *Ans.* 19.
3. How many dozen of gallon, quart and pint jugs, each a like number, will be required to contain a cask of Madeira, which contains 165 gallons? *Ans.* 10.

Time.

seconds.	minutes.	hours.	days.	weeks.	months.
60 =	1 =	$\frac{1}{24}$ =	$\frac{1}{365}$ =	$\frac{1}{52}$ =	$\frac{1}{12}$ =
3600 =	60 =	1 =	$\frac{1}{24}$ =	$\frac{1}{52}$ =	$\frac{1}{12}$ =
86400 =	1440 =	24 =	1 =	$\frac{1}{7}$ =	$\frac{1}{4}$ =
604800 =	10080 =	168 =	7 =	1 =	$\frac{1}{4}$ =
2419200 =	40320 =	672 =	28 =	4 =	1 =
31557600 =	525960 =	8766 =	365 $\frac{1}{4}$ =	52w. 1d. 6h. =	1yr.

Examples.

1. Reduce 31557600 seconds to a year of 365 days, 6 hours.
Answer—1 year.
2. How many hours, minutes and seconds are there in a year.
Answer—8766h. 525960m. 31557600sec.

Motion.

seconds.	minutes.	deg.	signs.	revolutions.
60 =	1 =	$\frac{1}{360}$ =	$\frac{1}{12}$ =	$\frac{1}{360}$ =
3600 =	60 =	1 =	$\frac{1}{12}$ =	$\frac{1}{360}$ =
108000 =	1800 =	30 =	1 =	$\frac{1}{12}$ =
1296000 =	21600 =	360 =	12 =	1 =

Examples.

1. In 6 signs of the zodiac, how many minutes.
Ans. 10800.
2. How many seconds are there in a complete revolution of any planet?
Ans. 1296000.

Practical Questions in the reduction of Money, Weights and Measures.

1. How many cents are equivalent to 6 eagles? *Ans.* 6000.
2. How many marks are in 1428l. *Ans.* 2142.
3. In 375 Ducats of 4/6 $\frac{1}{2}$ d. each, how many pounds.
Ans. £.85 3s. 1 $\frac{1}{2}$ d.
4. In 84012 half pence, how many pounds, &c.
Ans. £.175 0s. 6d.
5. Change £100 New-York into Virginia currency.
Answer. £75.
6. If a merchant remits to his correspondent in South Carolina £1200 Virginia currency, what credit will he receive?
Answer. £700.

7. Reduce £1500 Ohio currency into dollars. *Ans.* 4000.
 8. How many pounds Maryland currency are equal to 537 dollars? *Ans.* £201 7s. 6d.
 9. What is the value of £9000 Pennsylvania currency in the State of North Carolina? *Ans.* £9600.
 10. Reduce £400 Virginia currency to sterling. *Ans.* 300.
 11. How many plates, of 12 ounces each may be made of 4 Ingots of silver, each 72 ounces? *Ans.* 24.
 12. How much gold will make 276 rings weighing 3 dwt. 12 grs. each? *Ans.* 202. Odwt. 6grs.
 13. How many kegs each 14½ gallons may be filled from 2 casks of wine, containing together 217 gals. 2qts. *Ans.* 15.
 14. A carriage wheel which is 5 yards in circumference, and turns 1760 times, the distance is required. *Ans.* 5 miles.
 15. In $\frac{1}{4}$ of a mile square, how many acres? *Ans.* 40.
 16. In a mile square, how many acres? *Ans.* 640.
 17. In a triangle, the base of which is 176 poles, and perpendicular 96 poles, how many acres? *Ans.* 52a. 3r. 8po.
 18. How many times will a wheel whose circumference is 5 yards, turn round in going 5 miles? *Ans.* 1760.
 19. How many seconds of time have passed since the creation of the world, including the year 1808. *Ans.* 950935680.
 20. Required the number of yards that would reach round the globe of the earth, which is 360 degrees, and each degree 69½ miles? *Ans.* 44035200.

Vulgar Fractions.

A VULGAR FRACTION is one or more parts of an unit or integer, according as the same is expressed or divided, as $\frac{1}{2}$ one third; $\frac{1}{4}$ one eighth; $\frac{7}{8}$ seven eighths—the upper number is called the numerator, and shews the part or parts expressed by the fraction; the lower number is called the denominator, and denotes the number of such parts contained in a unit.

Vulgar fractions are either proper, improper, compound or mixt.

1. A proper fraction is one of which the numerator is less than the denominator; thus $\frac{1}{2}$, $\frac{3}{4}$, $\frac{11}{12}$.

2. An improper fraction is one of which the numerator is equal to, or greater than the denominator; thus, $\frac{2}{2}$, $\frac{2}{1}$, $\frac{8}{3}$.

3. A compound fraction is a fraction of a fraction; as $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{7}{8}$.

4. A mixed number consists of a whole number, and a fraction as, $6\frac{1}{2}$.

5. A mixed fraction has a fraction annexed either to its numerator or denominator; as $\frac{39}{22}$, $\frac{7}{8}$ or $\frac{76}{14}$, $\frac{12}{5}$.

Reduction of Vulgar Fractions.

TO REDUCE A FRACTION TO ITS LOWEST TERMS.

RULE 1. Divide the numerator and denominator by numbers that will leave them without remainders, until they can be divided no longer—or,

a. Divide the greater term by the less, and that divisor by the remainder, till nothing be left; the last divisor will be the common measure, by which divide both terms for the fraction required.

Examples.

1. Reduce $\frac{144}{168}$ to its lowest terms.

$$\frac{144}{168} = \frac{12}{14} = \frac{6}{7} \text{ Ans. } \left. \begin{array}{l} \text{OR,} \\ 144 \div 168 \end{array} \right\} \begin{array}{l} 144 \\ 168 \end{array}$$

Common Measure.

$$24 \overline{) 144(6)} \\ \underline{144} \\ 0$$

$$144 \overline{) 168} \frac{144}{168} = \frac{6}{7} \text{ Ans.}$$

2. Reduce $\frac{150}{175}$ to its lowest terms.

Ans. $\frac{6}{7}$

3. Reduce $\frac{168}{210}$ to its lowest terms.

— $\frac{4}{5}$

4. Reduce $\frac{180}{240}$ to its lowest terms.

— $\frac{3}{4}$

5. Reduce $\frac{288}{384}$ to its lowest terms.

— $\frac{3}{4}$

6. Reduce $\frac{200}{275}$ to its lowest terms.

— $\frac{8}{11}$

To reduce Fractions of different denominations, to Fractions of a common denominator.

RULE. Multiply the numerator of each fraction into all the denominators but its own, for its respective numerator, and all the denominators into each other, for a common denominator.

Examples.

1. Reduce $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{4}$ to a common denominator.

$$\left. \begin{array}{l} 1 \times 4 \times 8 = 32 \\ 3 \times 2 \times 8 = 48 \\ 5 \times 2 \times 4 = 40 \end{array} \right\} \text{Numerators.}$$

$$2 \times 4 \times 8 = 64 \text{ Common denominator. Ans. } \frac{32}{64} \frac{48}{64} \text{ \& } \frac{40}{64}$$

2. Reduce $\frac{7}{9}$, $\frac{2}{10}$ and $\frac{1}{12}$ to a common denominator.

Answer. $\frac{840}{900} \frac{864}{900} \text{ \& } \frac{880}{900}$

3. Reduce $\frac{4}{5}$, $\frac{1}{2}$, $\frac{3}{8}$ and $\frac{1}{4}$ to a common denominator.

Answer. $\frac{16}{40}$ $\frac{20}{40}$ $\frac{15}{40}$ & $\frac{10}{40}$.

4. Reduce $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{7}{16}$ and $\frac{1}{32}$ to a common denominator.

Answer. $\frac{16}{320}$ $\frac{120}{320}$ $\frac{200}{320}$ $\frac{125}{320}$ & $\frac{10}{320}$.

To reduce a mixed number to an improper Fraction.

RULE. Multiply the whole number by the denominator of the fraction, adding the numerator to the product for a new numerator, which placed over the denominator gives the required fraction.

Examples.

- | | | |
|---|------|-------------------|
| 1. Reduce $12\frac{1}{4}$ to an improper fraction. | Ans. | $51\frac{1}{4}$ |
| $12 \times 4 = 51$ new numerator. | Ans. | $51\frac{1}{4}$ |
| 2. Reduce $10\frac{7}{8}$ to an improper fraction. | — | $82\frac{7}{8}$ |
| 3. Reduce $18\frac{5}{6}$ to an improper fraction. | — | $113\frac{5}{6}$ |
| 4. Reduce $30\frac{3}{4}$ to an improper fraction. | — | $243\frac{3}{4}$ |
| 5. Reduce $514\frac{1}{8}$ to an improper fraction. | — | $4113\frac{1}{8}$ |
| 6. Reduce $27\frac{5}{8}$ to an improper fraction. | — | $216\frac{5}{8}$ |

To reduce an improper fraction to a whole or mixed number.

RULE. Divide the numerator by the denominator, and if any thing remains, place it over the denominator.

Examples.

1. Reduce $5\frac{1}{4}$ to its proper terms.

4) 54

$13\frac{3}{4}$ Answer.

- | | | |
|---|---------|------------------|
| 2. Reduce $8\frac{7}{8}$ to its proper terms. | Answer. | $107\frac{7}{8}$ |
| 3. Reduce $16\frac{3}{4}$ to its proper terms. | — | $164\frac{3}{4}$ |
| 4. Reduce $7\frac{6}{7}$ to its proper terms. | — | $109\frac{6}{7}$ |
| 5. Reduce $18\frac{1}{2}$ to its proper terms. | — | $18\frac{1}{2}$ |
| 6. Reduce $514\frac{1}{8}$ to its proper terms. | — | $514\frac{1}{8}$ |

To reduce a compound fraction to a single one.

RULE. Multiply all the numerators together for a new numerator, and all the denominators for a new denominator.

Examples.

1. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction. *Answer.* $\frac{6}{24}$ or $\frac{1}{4}$.
2. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction. *Answer.* $\frac{15}{24}$.
3. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction. — $\frac{9}{16}$.
4. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction. — $\frac{12}{16}$.
5. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction. — $\frac{3}{14}$.
6. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction. — $\frac{21}{40}$.

To reduce the fractions of one denomination to the fraction of another, but greater, retaining the same value.

RULE.—Reduce the given fraction to a compound one, by comparing it with all the denominations between it, and that denomination which you would reduce it to, which fraction, reduce to a single one.

Examples.

1. Reduce $\frac{1}{2}$ of a penny to the fraction of a pound. *Answer.* $\frac{1}{240}$.
2. Reduce $\frac{1}{2}$ of $\frac{1}{12}$ of $\frac{1}{10}$ = $\frac{1}{240}$ = $\frac{1}{240}$ £. *Answer.*
3. Reduce $\frac{1}{2}$ of a dram averduois to the fraction of a cwt. *Answer.* $\frac{1}{3360}$.
4. Reduce $\frac{1}{2}$ of a pint to the fraction of a hogshead. *Ans.* $\frac{1}{3360}$.
5. Reduce $\frac{1}{2}$ of $\frac{1}{2}$ of a scruple to the fraction of a pound. *Ans.* $\frac{5}{768}$.
6. Reduce $\frac{1}{2}$ of a minute to the fraction of a year. *Ans.* $\frac{1}{8760}$.

To reduce the fraction of one denomination to the fraction of another, but less, retaining the same value.

RULE.—Multiply the numerator by the parts contained in the several denominations between it, and that you would reduce it to, for a new numerator, and place it over the given denominator, which reduce to its lowest terms.

Examples.

1. Reduce $\frac{3}{500}$ of a pound to the fraction of a penny. *Answer* $\frac{3}{4}$.

2. Reduce $\frac{3 + 20 + 12}{1200} = \frac{720}{1200} = \frac{3}{5}d.$ of a pound troy to the fraction of a penny weight. *Ans.* $\frac{3}{5}$.

3. Reduce $\frac{2}{10000}$ of a cwt. to the fraction of a dram. *Ans.* $\frac{2}{7}$.

4. Reduce $\frac{5}{30000}$ of a hoghead to the fraction of a pint. *Ans.* $\frac{5}{6}$.

5. Reduce $\frac{3}{20000000}$ of a year to the fraction of a minute. *Ans.* $\frac{3}{4}$.

To find the proper value of a fraction in the known parts of an integer.

RULE.—Multiply the numerator by the common parts of the integer, and divide by the denominator.

Examples.

1. Reduce $\frac{7}{8}$ of a pound to its proper quantity. *Answer* 8s. 9d.

$$\begin{array}{r} 20 \\ 7 \\ \hline 16 \overline{)140} 8 \\ 128 \end{array}$$

8s. 9d. *Answer.*

$$\begin{array}{r} 12 \\ 12 \\ \hline 16 \overline{)144} 9 \\ 144 \\ \hline 0 \end{array}$$

2. Reduce $\frac{3}{4}$ of a shilling to its proper quantity. *Ans.* 9d.

3. What is the value of $\frac{5}{8}$ of a pound Troy? *Ans.* 7oz. 10dwt.

4. What is the value of $\frac{11}{15}$ of a cwt? *Ans.* 2qrs. 26lbs. 2oz. 2drs. $\frac{2}{3}$.

5. What is the value of $\frac{4}{7}$ of an Ell English? *Ans.* 1yd.

6. What is the value of $\frac{5}{8}$ of an acre? *Ans.* 2 roods 20 po.

7. What is the value of $\frac{4}{7}$ of a mile? *Ans.* 6fur. 16po.

8. What is the value of $\frac{6}{7}$ of a hhd. of wine? *Ans.* 54gals.
 9. What is the value of $\frac{9}{13}$ of a day? *Ans.* 16h. 36m. 55sec. $\frac{5}{13}$.
 10. What is the value of $\frac{9}{14}$ of a guinea? *Ans.* 18s.
 11. What is the value of $\frac{1}{8}$ of a dollar? *Ans.* 9d.
 12. What is the value of $\frac{15}{16}$ of a dollar. *Ans.* 5s. 7 $\frac{1}{2}$ d.

To reduce any given quantity to the fraction of any greater denomination of the same kind.

RULE.—Reduce the given quantity to the lowest term mentioned, for a numerator; and the integer into the same name for a denominator; which reduce to their lowest terms.

Examples.

1. Reduce 13s. 4d. to the fraction of a pound. *Ans.* $\frac{2}{3}$ £.

	s.	d.
20	Integral part.	13 4
12		12
240	denominator.	160
		numerator.

Ans. $\frac{160}{240} = \frac{2}{3}$ £.
 2. Reduce 7ozs. 10dwts. troy, to the fraction of a pound. *Answer* $\frac{5}{8}$.
 3. Reduce 2qrs. 26lbs. 2oz. 2 $\frac{1}{2}$ drs. to the fraction of a cwt. *Answer* $\frac{1}{11}$.
 4. Reduce 1 yard to the fraction of an Ell English. *Answer* $\frac{4}{5}$.
 5. Reduce 6 furlongs, 16 poles, to the fraction of a mile. *Answer* $\frac{4}{5}$.
 6. Reduce 54 gallons of wine to the fraction of a hogshead. *Answer* $\frac{6}{7}$.

To reduce fractions of one denomination to another of the same value, having the numeration given of the required fraction.

RULE.—As the numerator of the given fraction is to its denominator, so is the numerator of the intended fraction to its denominator.

Examples.

1. Reduce $\frac{3}{4}$ to a fraction of the same value, whose numerator shall be 15. As 3 :: 4 :: 15 :: 20.
Ans. $\frac{15}{20} = \frac{3}{4}$.

2. Reduce $\frac{7}{8}$ to a fraction of same value, the numerator of which shall be 42. *Ans.* $\frac{42}{8}$.

3. Reduce $\frac{4}{5}$ to a fraction of the same value, the numerator of which shall be 73. *Ans.* $\frac{73}{11}$.

To reduce fractions of one denomination to another of the same value, having the denominator given of the given fraction required.

RULE.—As the denominator of the given fraction is to its numerator, so is the denominator of the intended fraction to its numerator.

Examples.

1. Reduce $\frac{3}{4}$ to a fraction of the same value, whose denominator shall be 20. As $4 :: 3 :: 20 :: 15$. *Ans.* $\frac{15}{20} = \frac{3}{4}$.

2. Reduce $\frac{5}{6}$ to a fraction of the same value, the denominator of which shall be $131\frac{2}{3}$. *Ans.* $\frac{73}{11}$.

3. Reduce $\frac{2}{3}$ to a fraction of the same value, the denominator of which shall be $65\frac{2}{3}$. *Ans.* $\frac{47}{5}$.

To reduce a mixed fraction to a single one.

RULE.—Multiply each term of the principal fraction by the denominator of that annexed, for the like term of the simple fraction, adding in the annexed numerator to the product of the term to which it belongs.

Examples.

1. Reduce $3\frac{2}{3}$ to a simple fraction. *Ans.* $\frac{11}{3}$.
 $36 \times 3 \times 2 = 110$ Numerator.

$48 \times 3 = 144$ Denominator.

2. Reduce $2\frac{3}{4}$ to a simple fraction. *Ans.* $\frac{11}{4}$.

3. Reduce $7\frac{3}{4}$ to a simple fraction. *Ans.* $\frac{5}{4}$.

$73 \times 5 = 365$ Numerator.

$131 \times 5 \times 2 = 657$ Denominator.

4. Reduce $7\frac{2}{3}$ to a simple fraction. *Ans.* $\frac{22}{3}$.

Addition of Vulgar Fractions.

RULE.—Reduce the given to their least common denominator, compound fractions to simple ones; then add all the numerators together, under which place the common denominator.

Examples.

1. Add $\frac{2}{3}$ and $\frac{3}{4}$ together.
 $\frac{2}{3} \frac{3}{4} \frac{8}{12} \times \frac{3}{3} = \frac{26}{12} = 1\frac{5}{6}$ *Answer.*
2. Add $\frac{3}{4}$ $\frac{5}{7}$ and $\frac{3}{8}$ together. *Ans.* $1\frac{17}{56}$.
3. Add 19, 7 and $\frac{1}{2}$ of $\frac{3}{4}$ together. *Ans.* $26\frac{3}{4}$.
4. Add $\frac{1}{3}$ of 95 and $\frac{7}{8}$ of 14 together. *Ans.* $43\frac{11}{24}$.
5. Add $\frac{3}{4}$, $9\frac{1}{2}$ and $\frac{2}{3}$ of $\frac{1}{2}$ together. *Ans.* $9\frac{103}{104}$.
6. Add $\frac{1}{2}$ of $\frac{7}{8}$ and $\frac{4}{5}$ of $\frac{1}{2}$ together. *Ans.* $1\frac{17}{40}$.
7. Add $\frac{1}{8}$ of $\frac{1}{4}$ of a pound and $\frac{1}{4}$ of a pound together.
Ans. $1\frac{1}{2}$ 9s. 7d.
8. To $10\frac{1}{2}$ shillings add $\frac{1}{2}$ of $\frac{1}{2}$ of a shilling.
Ans. 6s. 11d.
9. To $7\frac{1}{2}$ pounds add $3\frac{1}{2}$ shillings together.
Ans. 7s. 13s. 1d.
10. To $\frac{1}{2}$ of a pound troy add $\frac{7}{8}$ of an oz.
Ans. 6oz. 11dwt. 16grs.
11. To $\frac{1}{4}$ of a ton add $\frac{9}{10}$ of an cwt.
Ans. 12c. 1qr. 8lb. 12oz. $12\frac{1}{2}$ drs.

Subtraction of Vulgar Fractions.

RULE.—Prepare the fractions as in addition, and subtract the lower numerator from the upper, and place the difference over the common denominator.

When the lower numerator is greater than the upper, subtract it from the common denominator, and add in the upper numerator, carrying 1, to the units place of the integer.

Examples.

1. From $\frac{11}{12}$ take $\frac{3}{4}$.
 $\frac{11}{12} - \frac{3}{4} = \frac{11}{12} - \frac{9}{12} = \frac{2}{12} = \frac{1}{6}$ *Ans.*
2. From $\frac{1}{2}$ take $\frac{3}{7}$. *Ans.* $\frac{1}{14}$.
3. From $\frac{2}{3}$ take $\frac{1}{5}$. *Ans.* $\frac{7}{15}$.

4. From $37\frac{1}{2}$ take $19\frac{1}{2}$. *Ans.* $17\frac{1}{2}$.
 5. From $196\frac{1}{2}$ take $14\frac{1}{2}$. *Ans.* $181\frac{1}{2}$.
 6. From $13\frac{1}{2}$ take $\frac{1}{4}$ of 15. *Ans.* $27\frac{1}{2}$.
 7. From $2\frac{5}{8}$ of a pound take $1\frac{1}{2}$ pounds. *Ans.* £ 1. 6s. 8d.
 8. From $\frac{3}{4}$ of a pound take $\frac{1}{4}$ of $\frac{1}{6}$ of a shilling. *Ans.* 12s. $8\frac{1}{2}$ d.
 9. From $\frac{1}{2}$ of an ounce troy take $\frac{1}{4}$ of a dwt. *Ans.* 13dwt. $12\frac{6}{8}$ grs.
 10. From $\frac{1}{2}$ of an cwt. take $\frac{1}{2}$ of a pound. *Ans.* 1qr. 27lb. 6oz. $10\frac{2}{3}$ drs.
 11. From $\frac{1}{2}$ of a league take $\frac{1}{3}$ of a mile. *Ans.* 1m. 1fur.
 12. From 5 weeks take $19\frac{1}{2}$ days. *Ans.* 15da. 4b. 48m.
-

Multiplication of Vulgar Fractions.

RULE.—Reduce compound fractions to single ones, and mixed numbers to improper fractions; then multiply the numerators together for a new numerator, and the denominators for a new denominator.

Examples.

1. Multiply $\frac{2}{3}$ by $\frac{3}{4}$. *Ans.* $\frac{2}{4}$.
 $\frac{2}{3} \times \frac{3}{4} = \frac{6}{12} = \frac{1}{2}$ *Ans.*
 2. Multiply $\frac{4}{5}$ by $\frac{3}{4}$. *Ans.* $\frac{3}{5}$.
 3. Multiply 24 by $\frac{2}{3}$. *Ans.* 16.
 4. Multiply $\frac{1}{2}$ of 5 by $\frac{3}{4}$ of $\frac{2}{7}$. *Ans.* $\frac{5}{14}$.
 5. Multiply $\frac{3}{7}$ of $\frac{5}{8}$ by $\frac{4}{5}$ of $\frac{1}{2}$ of $11\frac{3}{4}$. *Ans.* $\frac{64}{147}$.
 6. Multiply $\frac{1}{2}$ of 7 by $\frac{3}{6}$. *Ans.* $1\frac{1}{4}$.
 7. Multiply $12\frac{1}{2}$ by $\frac{1}{2}$ of 7. *Ans.* $29\frac{1}{2}$.
 8. Multiply $9\frac{1}{2}$ by $\frac{2}{6}$. *Ans.* $3\frac{1}{3}$.
 9. Multiply $\frac{3}{4}$ of $\frac{4}{7}$ of 5 by $\frac{1}{2}$ of 7. *Ans.* 3.
 10. Multiply $7\frac{1}{2}$ pounds by $\frac{2}{6}$ of a pound. *Ans.* £ 6. 5s.
-

Division of Vulgar Fractions.

RULE.—Prepare the fractions when necessary, invert the divisor, and proceed as in Multiplication.

Examples.

- | | | |
|---|--|------------------------------|
| 1. Divide $\frac{17}{21}$ by $\frac{5}{3}$. | $\frac{17 \times 5}{21 \times 3} = \frac{85}{63} = 1\frac{22}{63}$ | <i>Ans.</i> $1\frac{22}{63}$ |
| 2. Divide $\frac{4}{7}$ by $\frac{8}{11}$. | | <i>Ans.</i> $1\frac{11}{14}$ |
| 3. Divide $\frac{14}{18}$ by $\frac{7}{10}$. | | $1\frac{1}{3}$ |
| 4. Divide $1\frac{1}{2}$ by $4\frac{8}{10}$. | | $\frac{5}{8}$ |
| 5. Divide $5\frac{1}{8}$ by $7\frac{3}{4}$. | | $\frac{41}{224}$ |
| 6. Divide 7 by $\frac{3}{8}$. | | $18\frac{2}{3}$ |
| 7. Divide $\frac{1}{5}$ of 19 by $\frac{2}{3}$ of $\frac{3}{4}$. | | $7\frac{1}{2}$ |
| 8. Divide 16 by 24. | | $\frac{2}{3}$ |
| 9. Divide $\frac{7}{8}$ by 4. | | $\frac{7}{32}$ |
| 10. Divide $\frac{2}{3}$ of $\frac{1}{4}$ by $\frac{1}{2}$ of $\frac{2}{3}$. | | $1\frac{1}{2}$ |

Decimal Fractions,

A Decimal Fraction is either a part or parts of an unit, denoted by a point prefixed or set, before a figure, or figures, thus: $\cdot 7$ $\cdot 35$ $\cdot 327$; the first figure after the point, denoting so many tenths of a unit; the second, so many hundredths of a unit; and the third, so many thousandths of a unit; which are equal to, and read as follows, viz: $\frac{7}{10}$ $\frac{35}{100}$ $\frac{327}{1000}$.

A mixed number consists of a whole number and a decimal, thus, 465.356 ; which is, $465\frac{356}{1000}$.

As whole numbers, when counted from the right hand to the left, increase in a ten-fold proportion; so decimals, counted towards the right, decrease in the same proportion, which is fully exemplified in the following

Table.

9	C. of Millions.
8	X. of Millions.
7	Millions.
6	C. of Thousands.
5	X. of Thousands.
4	Thousands.
3	Hundreds.
2	Tens.
1	Units.
1	Tenth part.
2	Hundredth parts.
3	Thousandth parts.
4	X. Thousandth parts.
5	C. Thousandth parts.
6	Millionth parts.
7	X. Millionth parts.
8	C. Millionth parts.
9	M. Millionth parts.

Cyphers annexed to decimals, neither increase nor decrease their value; $.35000$, and $.35$ are equal; but prefixed, decrease them in a ten-fold proportion; $.3$, $.03$, $.003$ all express different decimals, and are equal to $\frac{3}{10}$, $\frac{3}{100}$, $\frac{3}{1000}$.

NOTE.—In Decimals 1-4th of any thing is equal to $.25$, 1-2 equal to $.5$, and 3-4ths to $.75$, &c. &c.

Addition of Decimals.

RULE.—Place the numbers so that the points may stand under each other, and then proceed as in Simple Addition.

Examples.

1
Yards.
 $\begin{array}{r} .7638 \\ .385 \\ .7586 \\ .385 \\ 7.3858 \\ \hline 9.6782 \end{array}$

2
Pounds.
 $\begin{array}{r} 743.681 \\ .435 \\ 16.45 \\ 1.356 \\ .35 \\ \hline \end{array}$

3. Find the sum of $3.075 + .175 + .1.30 + 6.7 + .6$
Ans. 11.850.

4. If $346.784 + 96.9 + 4.321 + 60.073 + .300.003 + .013$, be added together, what is the sum? *Ans.* 808.094.

Subtraction of Decimals.

RULE.—Place the numbers, as in Addition, with the least under the greatest, then subtract as in Simple Subtraction, and in the difference observe to set the point directly under those in the example.

Examples.

	Yards.	lbs.	Ells.
1. From	67.43	2d.—360.03	3d.—3650.656
Take	47.246576	16.94	326.4021
Remainder	20.183433		

4. From 100.64 take 64.321 and what is left. *Ans.* 36.319.
 5. What is the difference between 3860.75. and .1.1666.
Ans. 3859.5834-
 6. What is the difference between 16.433. and 9.16?
Ans. 7.273

Multiplication of Decimals.

RULE.—Place the numbers as in Simple Multiplication, and multiply accordingly, remembering to point off as many places for decimals in the product, as there are decimals in both factors: but if decimal places be wanting in the product, supply them with cyphers to the left hand.

NOTE.—Multiplication of Decimals may be contracted, by setting the units figure of the multiplier, under such place of the multiplicand as is to be the lowest retained in the product; and placing all the remaining figures of the multiplier in an inverted order: in multiplying begin with the figure in the multiplicand, which stands over the multiplying figure, adding the increase which may arise, by carrying one for the first five, and one more for every ten after, and placing the products so, that the right hand figures stand under each other.

Examples.

1. Multiply 743.56815 by 52.647.

Contracted, and to contain three decimal places.

$$\begin{array}{r}
 743.56815 \\
 \times 52.647 \\
 \hline
 510497705 \\
 297427260 \\
 446140890 \\
 148713630 \\
 371784075 \\
 \hline
 \end{array}$$

Ans. 39146.63239305

$$\begin{array}{r}
 743.56815 \\
 \times 52.647 \\
 \hline
 37178408 \\
 1.487136 \\
 446141 \\
 29742 \\
 5205 \\
 \hline
 \end{array}$$

Ans. 39146.632

2. Multiply 37.38467 by 375.38
 3. Multiply .3759 by .945
 4. Multiply .84179 by .0385
 5. Multiply 8.64704 by .2575

Ans. 10294.9964246
Ans. .3552255
Ans. .032408915
Ans. 2.0721128

6. Multiply 3.141592 by 52.7438, and leave only four places of decimals in the product. *Ans* 165.6904

7. Multiply 2.38645 by 8.2175, and reserve only four places of decimals in the product. *Ans* 19.6107

8. Multiply 27.14986 by 92.41035, and retain six places of decimals in the product. *Ans* 2508.928065

9. Multiply 184.8207 by 13.57493, retaining only three places of decimals in the product. *Ans* 2508.928

10. Multiply 674.4375 by 27 368, reserving only the integers in the product. *Ans* 18458.

When any number of decimals is to be multiplied by 10, 100, 1000, &c. it is only removing the separating point in the multiplicand so many places towards the right hand, as there are cyphers in the multiplier: thus, $.578 \times 10 = 5.78$, $.578 \times 100 = 57.8$, $.578 \times 1000 = 578$, &c. &c.

Division of Decimals.

RULE.—Divide as in Simple Division, pointing off as many figures for decimals, in the quotient, as the dividend has more than the divisor.

NOTE 1. If the divisor and dividend have both the same number of decimal parts, the quotient will be a whole number.

2. If the dividend has not so many places of decimals as are in the divisor, then so many cyphers must be annexed to the dividend as will make them equal, and the quotient will then be a whole number.

3. But if when the division is done, the quotient has not so many figures, as it should have places of decimals, then so many cyphers must be prefixed as there are places wanting.

Examples.

1 3.08)273.408563(88.7690. *Ans*.

2464

2700

2464

2368

2156

2125

1848

2776

2772

...43

2. Divide 3857.60846785 by .384758 *Answer* 10026.06 +
3. Divide .384086748 by .32784 *Answer* .0011715 +
4. Divide 1425. by .6252 *Answer* 22792.70 +
5. Divide 8564.825 by 6.321 *Answer* 1354.9
6. Divide 6.7258 by 647. *Answer* .010395 +
7. Divide .0008136 by 678. *Answer* .000012
8. Divide 9. by .9 *Answer* 10.
9. Divide .9 by 9. *Answer* .1
10. Divide .3 by 3. *Answer* .1

When numbers are to be divided by 10, 100, 1000, &c. it is performed by placing the separating point in the dividend so many places towards the left hand, as there are cyphers in the divisor.

$$\begin{array}{l} \text{Thus, } 3784 \div 10 = 378.4 \quad || \quad 3784 \div 1000 = 3.784 \\ \quad \quad 3784 \div 100 = 37.84 \quad || \quad 3784 \div 10000 = .3784 \end{array}$$

Contracted Division.

RULE.—What ever place of the dividend corresponds with the units place of the divisor, at the setting out of the division, the same place must the first figure of the quotient have.

When dividing, reject the last right hand figure of the divisor, at every step, (instead of bringing down a figure as is common) and make the last remainder the dividend for the new divisor at every step: thus continuing the division until the divisor be exhausted.

Examples.

11. $99.5678 \overline{) 4.6789837568}$ (.0469931 *Answer.*
 3982712

$$\begin{array}{r} 99.567 \overline{) 696271} \\ 597402 \\ \hline \end{array}$$

$$\begin{array}{r} 99.56 \overline{) 98869} \\ 89604 \\ \hline \end{array}$$

$$\begin{array}{r} 99.5 \overline{) 9265} \\ 8955 \\ \hline \end{array}$$

$$\begin{array}{r} 99. \overline{) 319} \\ 297 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \overline{) 13} \\ 9 \\ \hline \end{array}$$

Remainder 4

12. Divide 6109.2674 by 240.649 and let there be 4 places of decimals in the quotient. *Answer* 25.3451+

13. Divide 913.08 by 2137.2, and leave 3 places of decimals. *Answer* .427+

NOTE.—That in working in Contracted Division, we come nearer the truth, by multiplying every figure left out in the divisor, when we carry 1, if it be 5 or upwards to 15; if 15 or upwards to 25, 2; if 25, or upwards to 35, 3, &c. The two last examples above are performed, with observation to this note.

Reduction of Decimals.

To reduce a Vulgar Fraction to a Decimal.

RULE.—Annex as many cyphers to the numerator as may be necessary, which divide by the denominator, the quotient will be the decimal.

Examples.

1. Reduce $\frac{1}{4}$ to a decimal

$$4 \overline{) 1.00}$$

25 *Ans.*

2. Reduce $\frac{1}{2}$ to a decimal. Ans .5
3. Reduce $\frac{1}{4}$ to a decimal. Ans .75
4. Reduce $\frac{1}{8}$ to a decimal. Ans .625
5. Reduce $\frac{1}{16}$ to a decimal. Ans .1923076
6. Reduce $\frac{1}{32}$ of $\frac{1}{17}$ to a decimal. Ans .6043956+
7. Reduce $\frac{1}{64}$ to a decimal. Ans .6875
8. Reduce $3\frac{1}{2}$ to a decimal. Ans 3.5
9. Reduce $2\frac{1}{2}$ to a decimal. Ans 2.5
10. Reduce $\frac{2}{3}$ to a decimal. Ans .41379+

To reduce the different denominations of Money, Weights, Measure, &c. to a Decimal.

RULE.—Place the several denominations above each other letting the highest denomination stand at bottom, then divide each denomination, (beginning at the top) by its value in the next denomination, the last quotient will give the decimal required.

Examples.

1. Reduce 6s. 5 $\frac{1}{2}$ d. to the decimal of a pound.

$$\begin{array}{r}
 41 \text{ .} \\
 12 \overline{) 5 \text{ . } 25} \\
 20 \overline{) 6 \text{ . } 4375} \\
 \hline
 .321875 \text{ Ans.}
 \end{array}$$

- R educe 8 oz. 12 dwts. 14 gra. to the decimal of a pound

$$\begin{array}{r}
 34 \overline{) 14 \text{ .}} \\
 20 \overline{) 12 \text{ . } 5833} \\
 12 \overline{) 8 \text{ . } 629165} \\
 \hline
 .719097
 \end{array}$$

3. Reduce 10s. 8d. to the decimal of a pound. Ans .5333+
4. Reduce 19s. 4d. to the decimal of a pound. Ans .96665
5. Reduce 10 $\frac{1}{2}$ d. to the decimal of a pound. Ans .04375
6. Reduce 9s. to the decimal of a pound Ans .45
7. Reduce 15s. to the decimal of a pound Ans .75
8. Reduce 2qrs. 14lb to the decimal of an Cwt. Ans .625
9. Reduce 3qrs. 3 nails to the decimal of a yard. Ans .9375

10. Reduce 7cwt. 3qrs. 17lb 10 oz. 12 drs. to the decimal of a Tun. *Ans* .39538 $\frac{1}{2}$
 11. Reduce 3bus. 1pk. 1gal. to the decimal of a barrel. *Ans* .675
 12. Reduce 37gal. 1pot. 1qt. to the decimal of a Hhd. *Ans* .5992
 13. Reduce 5fur. 12po. to the decimal of a mile. *Ans* .6615
 14. Reduce 4 perches to the decimal of an acre. *Ans* .025
 15. Reduce 7 minutes to the decimal of a day. *Ans* .00480 $\frac{1}{2}$
 16. Reduce 3cwt. 2qrs. 14lb. to an Cwt. *Ans* 3.625

To find the value of any given Decimal in the terms of the Integer.

RULE.—Multiply the given decimal, by the number of parts in the next inferior denomination, pointing off the decimals from the product, then multiply the remainder by the next inferior denomination; thus proceeding, till you have brought in the least known parts of the integer.

Examples.

1. What is the value of .7854166 of a pound ?
 .7854166

$$\begin{array}{r}
 20 \\
 \hline
 15.7083320 \\
 12 \\
 \hline
 8.4999840 \\
 4 \\
 \hline
 \end{array}$$

1.9999360 *Ans* 15s. 8 $\frac{1}{2}$ d. $\frac{1}{2}$

2. What is the value of .0375 of a pound. *Ans* 9d.
 3. What is the value of .7 of a pound Troy ? *Ans* 8oz. 8dwt.
 4. What is the value of .625 of an Cwt. ? *Ans* 3qrs. 14lb.
 5. What is the value of .075 of a gallon ? *Ans* 2 gills $\frac{1}{2}$
 6. What is the value of .675 of a barrel ? *Ans* 3bus. 1pk. 1gal.
 7. What is the value of .5 of a year ? *Ans* 6 months.
 8. What is the value of .9375 of a yard ? *Ans* 3qr. 3na.
 9. What is the value of .3375 of an acre ? *Ans* 1r. 14pe.
 10. What is the value of .625 of a shilling ? *Ans* 7 $\frac{1}{2}$ d.

11. What is the value of 761 of a day?

Ans. 18ho. 15min. 50 . 4 seconds.

12. What is the value of .4712 of an Ell English?

Ans. 2qr. 1 . 424 na.

The Single Rule of Three.

THE SINGLE RULE OF THREE is that wherein three numbers or terms are given, two of which are of one kind, to find a fourth proportional number of the same name with the other given terms; and this consists of two proportions, viz. Direct and Inverse.

Rule for Stating, &c.

Of the two similar terms, set that in the first place which implies the supposition, that of the same kind with the term sought in the second place, and that on which the demand lies in the third—If the first and third be not of one denomination, reduce both to the lowest in either, and the second to the lowest given denomination; then consider whether the proportion be direct or inverse.

Direct Proportion.

DIRECT PROPORTION is that wherein the third term is greater than the first, and requires the fourth term to be greater than the second; or the third less than the first, and requires the fourth to be less than the second; for, as often as the third term is greater or less than the first, so many times will the fourth be greater or less than the second; thus:

	yd.	s.	yd.	s.	
As	{ 3	.. 6	:: 9	.. 18	more requiring more.
	{ 20	.. 40	:: 5	.. 10	less requiring less.

RULE—Multiply the second and third terms together, and divide the product by the first; the quotient will be the fourth, or answer to the question, in the same denomination with the second, or into which it was reduced.

Proof.

STATE the question anew, changing the first and third terms, putting the answer in the place of the second term: When the work is right, the new answer will be the original second term.

RULE OF THREE.

NOTE.—Many of the operations of the questions belonging to this rule may be shortened by dividing the dividing term, and either of the other two, one by the other, or by any number that will divide them both without a remainder, and using their quotients in their stead, cancelling the figures so contracted, as denoted by this dash /, in the two subsequent examples.

Thus: If 24 yards cost 60 dollars, what are eight yards worth?

<i>yds.</i>	<i>\$.</i>	<i>yds.</i>	Or thus, contracted.
As 24 ..	60 ::	8	12)
<u> </u>	<u> </u>	<u> </u>	As 24 .. 60 :: 8
3	20 dols. Ans.		<u> </u>
That is, 24 ÷ 8 = 3			2
and 60 ÷ 3 = 20 dols.			5
			<u>8</u>

2)40

20 dols. Ans.

Or thus, contracted,

12)	2)
As 24 ..	60 :: 8
<u> </u>	<u> </u>
2	5
	4

20 dols. Ans.

The common operation, thus,

<i>yds.</i>	<i>\$</i>	<i>yds.</i>
As 24 ..	60 :: 8	
<u> </u>	<u> </u>	
	8	

24)480(20dols Ans:
48

...0.

Examples.

If 8 $\frac{1}{2}$ lb. of tobacco cost 56 cents, what will 4864 lb. come to?

Operation by the common method.

<i>lb.</i>	<i>cts.</i>
As 8 ..	56 :: 4864
<u> </u>	<u> </u>
	56
	29184
	24320
	<u> </u>
8	7272384

34048 cts. = \$340 48 cts.

The shortened method.

As 8 ..	56 :: 4864
<u> </u>	<u> </u>
	608
	56
	<u> </u>
	3648
	3040
	<u> </u>

34048 cts. = \$340 48.
dls. cts.

RULE OF THREE.

2. If 1*lb.* of allspice cost 2*s.* 6*d.* what will 420*lb.* cost?
Answer—£ 52 10*s.* 0*d.*
3. What is the value of 19 yards of muslin at 29*s.* 6*d.* per yard?
Ans. £ 28 0*s.* 6*d.*
4. If 200*s.* of twist cost 2*s.* 6*d.* what will 7*lbs.* cost?
Ans. £ 7 0*s.* 0*d.*
5. What is the value of 3 *cwt.* of coffee at 18*d.* per pound?
Ans. £ 25 4*s.* 0*d.*
6. If 1 pair shears cost 2*s.* 3*d.* what will 19 dozen pair come to?
Ans. £ 25 13*s.* 0*d.*
7. What is the value of 5 pieces linen, each 12 Ells, at 4*s.* 6*d.* per Ell?
Ans. £ 13 10*s.* 0*d.*
8. What is the value of a tankard which weighs 2*lbs.* at 5*s.* 6*d.* per oz?
Ans. £ 6 12*s.* 0*d.*
9. How many yards of lace may be purchased for £ 100 at 3*s.* 6*d.* per yard?
Ans. 571 $\frac{1}{2}$ yds.
10. A person bought a piece of cloth with £ 22 10*s.* at 15*s.* per yard, how many yards did it contain?
Ans. 30 yds.
11. What will 15 *cwt.* 1 qr. 19 *lb.* steel come to at 15*d.* per pound?
Ans. £ 107 18*s.* 9*d.*
12. If a man spends 15*d.* per day, how much is that a year?
Ans. £ 22 16*s.* 3*d.*
13. At a noble per week, how many months board may I have for £ 30?
Ans. 22 $\frac{1}{2}$ months?
14. What will 500 acres of land come to at 8 dollars 50 cents per acre?
Answer—4250 dollars.
15. If 75 *lbs.* of sugar cost £ 2 19*s.* 4 $\frac{1}{2}$ *d.* what will 7 *cwt.* 2 qrs. 18 *lbs.* come to at the same rate?
Ans. £ 33 19*s.* 3*d.*
16. When the tun of wine costs £ 60, what is that per gallon?
Answer—4*s.* 9*d.*
17. If you purchase 420 yards of cloth at 10*s.* 11 $\frac{1}{2}$ *d.* per Ell English, how much does it cost?
Ans. £ 184 2*s.* 0*d.*
18. If I purchase 750 acres of land with £ 587, what does it cost per acre?
Ans. 15*s.* 7 $\frac{3}{4}$ *d.*
19. A merchant bought 142 sacks of salt, containing 4 $\frac{1}{2}$ bushels each, at 3*s.* 11 $\frac{1}{2}$ *d.* per bushel, how much had he to pay?
Ans. £ 127 2*s.* 8 $\frac{1}{2}$ *d.*
20. If 100 *lbs.* of Nutmegs cost £ 15 12*s.* 8*d.* what will 36 *cwt.* 2 qrs. 20 *lbs.* come to, at the same rate?
Ans. £ 642 4*s.* 4 $\frac{1}{2}$ *d.*
21. When 2 $\frac{1}{2}$ yards linen cost 13*s.* 7 $\frac{1}{2}$ *d.* what will 52 $\frac{1}{2}$ yards come to?
Ans. £ 15 17*s.* 5*d.*
22. If my estate is worth £ 500 10*s.* per annum, and my daily expence be 16*s.* 9 $\frac{3}{4}$, what sum have I at the years end?
Ans. £ 193 13*s.* 5 $\frac{1}{2}$ *d.*

23. A merchant in Richmond delivered £.357 18s. 6d. Virginia currency, to receive £.417 11s. 7d. Pennsylvania currency, what was one pound Virginia currency valued at in Pennsylvania?

Answer—£.1 3s. 4d.

24. Bought a quantity of plate weighing 4 lb. 5 oz. 16 dwts. at 62s. 8d. per ounce, how much did it cost?

Answer—£.168 11s. 5½d.

25. A merchant bought 218 yards of cloth at 14s. 3½d. per yard, for what sum must he sell the whole to gain 50 per cent?

Ans. £.233 13s. 4½d.

26. Bought a tun of wine for £.78 17s. at what must I sell it per quart to gain £.5 10s. by the whole, when there were 22 gallons taken out?

Ans. 22s. 4d.

27. When a bankrupt compounds with his creditors at 12s. 6d. in the pound, what is the merchants' quota, to whom he owes £.2000?

Ans. £.1250.

28. If a person failing in trade owed me £.977, for which I have received £.420 6s. 3½d. how much was it in the pound?

Ans. 8s. 7½d.

29. How many yards of cloth may be bought for £.14 8s. when 8 yards cost 24s?

Ans. 96.

30. If my cane 4 feet long cast a shade on level ground seven feet, what is the height of a monument, whose shade at the same time measures 148 feet?

Ans. 113½ feet.

NOTE.—The height of any object may be found by its shadow, viz: As the shadow of a stick or pole, perpendicular to the ground is to its length, so is the shadow of any building to its height.

31. If the shadow of a pole 12 feet long set erect, cast a shadow of 17½ feet, how high is that steeple whose shadow at the same time measures 280 feet?

Ans. 192 feet.

32. Two horses start at the same instant at one place, one jumps 20 feet, and the other 19 feet 10 inches, and gather in the same space of time—When they have ran 4 miles; how far will one be, before the other?

Ans. 176 feet.

33. A merchant bought 49 pipes of wine for 273 pounds, freight, duties and other charges, £.63 10s. and he would gain £.55 10s. by the sale of it; what must I give him for 23 pipes?

Ans. £.184.

34. Bought 1400 lbs. of pimento at 45s. per 100 lbs. and sold the same at 8d. per lb. what did I gain by the trade?

Ans. £.15 3s. 4d.

Examples in Dollars and Cents.

35. What will 500 acres of land come to at 8 dollars 50 cents per acre?

$$\begin{array}{rclcl}
 & a. & cents. & a. & \\
 \text{As } 1 & \dots & 850 :: & 500 & \\
 & & \dots 500 & & \\
 & & \hline
 & & 425000 \text{ cents.} & = 4250 \text{ dols.} & \text{—Ans.}
 \end{array}$$

36. What is the value in dollars of 27 cwt. 3 qrs. 15 lbs. of pepper; when 18 pound cost 19*s.* 6*d.* Virginia currency?

Ans. 563 dol. 87½ cents.

37. What will 1204 yards cloth come to at 3 dol. 25 cts. per yard?

Ans. 1913 dollars.

38. What costs 150 saddles, each 12 dol. 30 cents?

Ans. 1845 dollars.

39. When 8 yards linen costs 4 dols. 50 cts. what are 750½ yards worth?

Ans. 422 dols. 15 cts. +

40. How many dollars will pay for 8 pipes of Madeira, at the rate of £.65 1*s.* 1¼*d.* Virginia currency, per hoghead?

Ans. 3507 dollars.

Inverse Proportion.

INVERSE PROPORTION is that in which the third term is greater than the first, and requires the fourth to be less than the second, or the third less than the first, and requires the fourth to be greater than the second; For as often as the third term is greater or less than the first, so many times will the fourth be respectively less or greater than the second.—thus:

$$\begin{array}{l}
 \text{As } \left\{ \begin{array}{llll}
 \text{men.} & \text{days.} & \text{men.} & \text{days.} \\
 4 \dots & 6 :: & 8 & \dots 3 \text{ more requiring less.} \\
 \text{In wd.} & \text{In lg.} & \text{In wd.} & \text{In lg.} \\
 12 \dots & 12 :: & 3 & \dots 48 \text{ less requiring more.}
 \end{array} \right.
 \end{array}$$

RULE.—Multiply the first and second terms together, and divide their product by the third term; the quotient will be the fourth term or answer.

RULE OF THREE.

Proof.

As in Direct Proportion.

Examples.

1. If 48 men can build a bridge in 24 days, how many men will do the same in 384 days?

As 24 .. 48 :: 384

24

192

96

men

384) 1152 (3: Ans.

1152

0000

Contracted.

As 24 .. 48 :: 384

Answer 3 men.

That is, $384 \div 24 = 16$.

And $48 \div 16 = 3$.

...

2. If 25 men build a well in 8 days, how many men will do it in 5 days? Ans. 40.

3. How many yards of carpet, $\frac{1}{2}$ yard wide, will it take to cover a floor 18 feet by 30? Ans. 120.

4. Lent my friend 395 pounds for 9 months, how long shall he loan me 711 pound, to requite my kindness? Ans. 5 months.

5. When it takes $2\frac{1}{2}$ yards of cloth $1\frac{1}{2}$ yards wide, to make you a coat, how many yards baize $\frac{1}{2}$ yard wide will line it? Ans. $8\frac{1}{2}$ yards.

6. How many dollars at 4s. 4d. each; are equal in value to 360 guilders of 2s. 2d. each? Ans. 180 dollars.

7. If 150 men cast a trench in 24 hours; how many men will perform the same in 6 hours? Ans. 600 men.

8. If a labourer performs a piece of work in 16 days, when the days are 14 hours long; how long will he be doing the same work when the days are $9\frac{1}{2}$ hours long? Ans. $23\frac{1}{2}$ days.

9. How much in length, that is three inches broad, will make a foot square? Ans. 48 inches.

10. If £.100 principal in 12 months gain £.6 interest, what principal will gain the same in 8 months? Answer—£.150.

11. How much in length, that is 10 poles in breadth, must be taken to contain an acre? Ans. 16 perches.

12. How many yards of paper $1\frac{1}{2}$ yards wide, will be sufficient to hang a room, which is 20 yards in circumference, and 4 in height? Ans. 64 yards.

Practical Questions.

1. If a goldsmith sells a tankard for 10 pounds 12 shillings, at the rate of 5s. 4d. per ounce, what is its weight?

Answer—39 oz. 15 dwts.

2. A merchant bought 18 pipes of wine at 10s. Virginia currency per gallon, how many dollars will pay the purchase?

Ans. 3780 dollars,

3. If 5 and 3 make ten, what will 6 and 8 make?

Answer—17½.

4. Bought 27 yards of cloth, for which I gave £.37 10s. what was it per Ell Flemish?

Ans. £.1 1s. 1d.

5. Bought 46 Ells of English cloth at £.1 7s. 6d. per Ell, what did it cost per yard?

Ans. £.1 2s. 0d.

6. What quantity of sugar at 6½d. per pound, can I have for 40 barrels of corn at 12s. 6d. per barrel?

Ans. 923½ lbs.

7. Bought 120 pieces of cloth for £.476 14s. 9½d. it is required to know how many bushels of wheat at 5s. 4d. per bushel, will pay for it—as also the cost per piece?

Answer { 1787½ bushels.
£.3 19s. 5½d.

8. Suppose my salary to be 73 pounds a year, what is it per day?

Answer—4 shillings.

9. If the freight of a ship cost £.529 11s. what should be paid to A. B. for his ⅔ parts?

Answer—£.82 14s. 10½d.

10. If the earth performs its diurnal revolution in a solar day or 24 hours, in what time does it move one degree?

Answer—4 minutes.

11. If a ship is valued at £.537, what are ⅓ of her worth?

Answer—£.201 7s. 6d.

12. The earth being 360 degrees in circumference, turns round on its axis once in 24 hours; how far are the inhabitants at the equator carried in one minute, a degree there being 69½ miles?

Answer—17 miles, 3 furl.

13. Astronomers compute the earth's orbit, or track which it describes round the sun in 365 days 6 hours—to be about 59 900000 miles; how far then, per minute, must we be carried through the firmament by this wonderful motion?

Answer—1134 + miles.

14. Sir Isaac Newton and others, have found by nice experiment, that sound flies (if not interrupted) at the rate of 1142 feet per second, and a person in health has about 75 pulsations in a minute; now the breadth of a river is required, at one side of which A. firing a gun, B. directly opposite at the other, counts six pulsations at his wrist between seeing the flash and hearing the report?

Ans. 1 mile, 67 yards.

15. If the report of a piece of ordnance be heard one minute 3 seconds after the flash was observed; the distance is required.

Answer—13 miles, 5 fur.

16. Suppose a cistern to contain 1996 gallons of water, and by one pipe there runs into it 260 gallons in an hour, and by another pipe there runs out $253\frac{1}{2}$ gallons in an hour; required the time in filling the said cistern?

Answer—307 $\frac{1}{3}$ hours.

17. If when the price of wheat is 4s. per bushel, the penny loaf weighs 18ozs. what must the penny loaf weigh, when a bushel is worth 6 shillings?

Ans. 12 ounces.

18. If a piece of grass will graze 56 oxen six days; how many must be turned out, so that it may last the remainder 16 days?

Answer—35.

19. If my wages are 547 dollars 50 cents per annum, what is it per day?

Ans. 1 dol. 50 cents.

20. To what comes 3 Tuns of Madeira at 3 dollars 50 cents per gallon?

Ans. 2642 dollars.

21. When 640 yards of cloth cost 800 dollars, what is it per yard?

Ans. 1 dollar 25 cents.

22. Admit I lend a man £100 for 6 months, he promising me the like kindness, whenever I desire it; but coming to make the request, he can loan me only £75, query, the length of time I should keep his money to recompense my courtesy?

Ans. 8 months.

23. A gentleman has an estate of £720 17s. 6d. a year, what may he daily spend, and lay up £16 12s. 6d. per month?

Ans. £1 8s. 6d $\frac{1}{2}$ +

24. Of what length must a plank be that is 7 $\frac{1}{2}$ inches wide to measure 20 square feet?

Ans. 32 feet.

25. What is the weight of a pea to a steelyard, which being suspended 39 inches from the centre of motion, will equipoise 208lb. suspended at the draught end 3 quarters of an inch?

Ans. 4lb.

The Double Rule of Three.

THE DOUBLE RULE OF THREE is that wherein five numbers or terms are given to find a sixth, three of which are a supposition, and two a demand; and is either direct or inverse.

Rule for Stating.

SET the two terms of the supposition, which are like those of the demand, one under the other, in the first place; that of

the same kind with the term sought, in the second, and the two demanding terms in the third place, with the two correspondent terms of the supposition and demand on the same line, and of one denomination, as in the subsequent examples, viz.

1 If 3 men in 4 days earn £5, how much will 6 men earn in 12 days?

$$\begin{array}{ccc} \text{As 3 men} & \left\{ \begin{array}{c} £ \\ 5 \end{array} \right. & \left\{ \begin{array}{c} 6 \text{ men} \\ 12 \text{ days.} \end{array} \right. \end{array}$$

2. If 3 men earn £.5 in 4 days; in how many will 6 men earn £.30?

$$\begin{array}{ccc} \text{As 3 men} & \left\{ \begin{array}{c} £.5 \\ 4 \text{ days.} \end{array} \right. & \left\{ \begin{array}{c} 6 \text{ men} \\ £.30 \end{array} \right. \end{array}$$

To know whether the stating be direct or inverse; consider the upper pair of extremes, and the lower, each separately with the middle term, as a stating of the single rule, and try them as taught in that rule. If both lines be direct, the stating is in direct proportion, but if inverse, if either pair of the extremes be so—Thus the first example above is direct, the second inverse.

Direct Proportion.

RULE.—Divide the continual product of the two last extremes and middle term by that of the two first, and the quotient will be the sixth term, or answer.

Proof.

By two statings of the Single Rule of Three.

NOTE.—If either of the two first terms, or both will divide, or can be divided by any of the three last, or by any other number without a remainder—the operation may be abbreviated by cancelling them, and using their quotients in their stead.

Examples.

1. If 3 men in 4 days earn £.5, how much will 6 men earn in 12 days?

DOUBLE RULE OF THREE.

As 3 m. } 5 { 6 m.
4 da. }

12 72
5
12) 360

Ans. £.30

Contracted.

As 3 m. } 6 m. (2
4 da. } 6.5 { 12 da. (3

6
5

Ans. £.30

3. If £100 in 12 months gain 1.6 interest, what will £25 gain in four months? *Ans. 1.0 10s. 0d.*

3. If 750 bushels of oats serve 500 horses 6 days, how many bushels will serve 1000 horses 14 days? *Ans. 3500 bus.*

4. If 1000 lbs. of beef serve 250 seamen 7 days, how many pounds will serve 550 seamen 63 days? *Ans. 19800 lb.*

5. A waggoner having received 30s. for the carriage of 3 cwt. 150 miles, how much ought he to have for the conveyance of 7 cwt. 50 miles? *Answer—1.1 3s. 4d.*

6. If £100 in 12 months gain 1.5 interest, what will £63 gain in 6 months? *Ans. 1.1 11s. 6d.*

7. If 15s. pay 5 men for 6 days labour, how much will pay 20 men for 10 days labour. *Ans. 1.5.*

8. If a boatman receives 1.3 17s. 6d. for the carriage of 17 cwt. 3 qrs. 25 lbs. one hundred miles, how much should he receive for the carriage of 16 cwt. 3 qrs. 18 lb. one hundred and fifty miles? *Ans. 1.5 9s. 4½d. +*

9. Suppose 4 men in 12 days mow 48 acres, how many acres can 8 men mow in 16 days. *Answer—128.*

10. If a ship laden with 20 tun 17 cwt. sails 2500 miles and receives 1.50 for the voyage; what must a ship receive that sails 3000 miles laden with 15 tun? *Ans. 1.43 3s. 3½d. +*

Inverse Proportion.

RULE.—Transpose the inverse extremes; that is, set that of the first place under the third, and that in the third under the first; then work as in direct proportion.

Examples.

1. If 7 men can eat 84 lbs. of bread in 12 days, how many men can eat 100 lbs. in 5 days?

As 84 lb. } 7 m. { 100 lbs.
12 da. } 5 Inverse term.

5	12
—	—
420	1200
	7
	—

420 840 0 20 men—Answer.

84

0

Contracted.

As 84 lb. } 7 m. { 100 lb. (20 men.
12 da. } 5 da.

5	12
—	—
7	

2. If 50 men in 6 days cast a trench 30 yards long, how many men will cast one 200 yards long in 3 days?

Answer—666 $\frac{2}{3}$.

3. If 36 eagles serve for the board of 8 persons 18 months, how long will 72 eagles pay for the board of 24 persons?

Answer—12 months.

4. If £100 principal in 12 months gain £6 interest, what principal will gain £18 in 15 months.

Answer—£240.

5. What principal will raise £20 in 8 months, at 5 per cent per annum?

Answer—£600.

6. If a regiment consisting of 1000 soldiers use 5555 lbs. of beef in 757 days, how many soldiers can use 6787 lbs. of beef in 444 days?

Answer—2083 $\frac{1}{4}$.

7. Suppose the interest of £333 6s. 8d. for 9 months be £15, what principal in 12 months will gain £6?

Answer—£100.

8. Suppose £100 will defray the expenses of 5 men for 22 weeks and 6 days, how long will 12 men be expending £150?

Answer—14 weeks, 2 days.

Practical Questions.

1. If I employ a man to carry two hogsheds of tobacco at the rate of 12 shillings for 6 miles, how much must I pay him for the carriage of 6 hbds. 24 miles?

Answer—£7 4s. 0d.

2. If 48 bushels of wheat yield 576 bushels in one year, how many will 300 bushels yield in 5 years?

Answer—18000 bushels.

3. If 14 horses eat 56 bushels of corn in 16 days, how many bushels will be sufficient for 20 horses 24 days?

Answer—120 bushels.

4. If a family consisting of 9 persons spend 128 dollars in 9 months, how much will serve a family of 24 persons for 16 months?
Ans. 640 dollars.

5. If 20 hundred weight be carried 50 miles for £5, how much will 40 hundred weight cost to be conveyed 100 miles?
Ans. £.20.

6. If 8 men can mow 112 acres of wheat in 14 days, how many men will be sufficient to mow 2000 acres in 10 days?
Ans. 200 men.

7. What number of men can reap 240 acres in 12 days, when 36 men can reap 60 acres in 5 days?
Ans. 60 men.

8. A person put out £.86 to receive interest for the same, and when it had continued 8 months, he received for principal and interest £.88 17s. 4d.—Query; the rate per cent?
Ans. 5 per cent.

The Single Rule of Three in Vulgar Fractions.

Direct Proportion.

RULE—State the question; and when necessary, prepare the terms as taught in Reduction; then multiply the second and third terms together, and divide that product by the first. Or, invert the first term, and multiply the three together for the fractional answer, which divide as occasion may require.

Examples.

1. If $\frac{2}{3}$ of an Ell cost $\frac{7}{12}$ of a £. what is the value of $\frac{3}{4}$ of an Ell?

As $\frac{2}{3} \dots - \frac{7}{12} :: - \frac{3}{4} = \frac{103}{630} = \frac{1}{6} \text{ £.} = 3s. 4d. \text{ Ans.}$

2. If $\frac{1}{2}$ gallon of wine cost $\frac{5}{12}$ of a pound, what will 28 $\frac{1}{2}$ gallons come to?
Ans. £.23 9s. 5 $\frac{1}{2}$ d. +

3. If 1 lb. of pepper cost $\frac{1}{2}$ of a shilling, what will 303 $\frac{1}{2}$ cost?
Ans. £.7 11s. 8d.

4. What is the value of 176 $\frac{1}{2}$ yards of cloth, when $\frac{3}{4}$ of a yard costs $\frac{2}{3}$ of a £.?
Ans. £.94 2s. 8d.

5. If $\frac{2}{3}$ of a pound Cinnamon cost $\frac{3}{4}$ of $\frac{2}{3}$ of a shilling, what will 33 pounds cost?
Ans. £.1 4s. 9d.

6. If $\frac{1}{2}$ of $\frac{2}{3}$ of a yard cloth cost $\frac{1}{2}$ of £. $\frac{2}{3}$, what will 146 $\frac{2}{3}$ yards come to?
Ans. £.146 2s. 10 $\frac{1}{2}$ d.

7. If a gallon of rum cost £. $\frac{2}{3}$, what will 171 $\frac{1}{2}$ gallons cost?
Ans. £.68 10s.

8. What quantity of muslin at $\frac{5}{8}$ of $\frac{2}{3}$ of a £. per yard, can be purchased with £. 26 $\frac{2}{7}$? *Ans.* 48 yards.
9. If $\frac{2}{3}$ of $\frac{1}{4}$ of a shilling purchase $\frac{2}{3}$ of a lb. of ginger, what will £. $\frac{2}{3}$ buy? *Ans.* 17 $\frac{7}{8}$ lbs.
10. If $\frac{3}{4}$ of a yard of velvet cost £. $\frac{1}{3}$, what will 3 $\frac{5}{8}$ yards come to? *Ans.* £. 2 18s.
11. If $\frac{3}{4}$ of a cwt. cost £. 2 $\frac{2}{5}$, what will 384 $\frac{1}{2}$ lbs. come to? *Ans.* £. 15 1s. 0 $\frac{1}{4}$ $\frac{3}{8}$ d.
12. If I pay £. 73 1s. 3d. for the $\frac{1}{8}$ of a ship, what part of her can be purchased with £. 250 10s.? *Ans.* $\frac{3}{4}$.
13. A merchant having $\frac{2}{3}$ of lead mine sells $\frac{1}{4}$ of his part for £. 171, what is the value of the whole mine? *Ans.* £. 380.

Inverse Proportion.

RULE.—State the question, and prepare the terms as in Direct Proportion, then multiply the first and second terms together, and divide that product by the third; or invert the third term (instead of the first) and proceed as in Direct Proportion.

Examples.

1. What quantity of baize, that is $\frac{3}{4}$ yards wide, will line 7 $\frac{1}{2}$ yards of cloth, 1 $\frac{1}{2}$ yards wide? *Ans.* 15 yards.

First, $7\frac{1}{2} = \frac{15}{2}$ } As $\frac{1}{2} \dots \frac{1}{2} :: \frac{4}{3} = \frac{18}{3}$) 18 yards.
 Second, $1\frac{1}{2} = \frac{3}{2}$

2. How many yards of shalloon, that is $\frac{3}{4}$ yard wide, will it take to line 3 $\frac{1}{2}$ yards of cloth, which is $\frac{1}{8}$ yard wide?

Ans. 4 $\frac{1}{2}$ yards.

3. How many feet of plank 8 $\frac{3}{4}$ inches wide, will it take to lay a floor 24 feet 6 inches long and 18 $\frac{1}{4}$ feet wide?

Ans. 630 feet.

4. How many yards of matting 2 $\frac{1}{4}$ feet wide will cover a floor that is 22 feet long and 16 $\frac{1}{4}$ feet wide? *Ans.* 44 yards.

5. In exchanging 20 $\frac{1}{2}$ yards of cloth of 1 $\frac{1}{4}$ yards wide, for some of the same quality of $\frac{3}{4}$ yard wide, what quantity of the latter makes an equal barter?

Ans. 34 $\frac{1}{2}$ yards.

6. If 3 men can do a piece of work in 4 $\frac{1}{2}$ hours, in what time will 10 men perform the same work? *Ans.* 1 h. 21 m.

7. A. lends to B. £. 100 $\frac{2}{7}$ for 6 $\frac{1}{2}$ months, what sum should B. lend A. for 3 $\frac{1}{2}$ years, to requite his kindness?

Ans. £. 14 11s. 9 $\frac{1}{4}$ $\frac{5}{8}$ d.

8. If your cloak contains $5\frac{1}{2}$ yards of cloth, that is $\frac{7}{8}$ yds. wide, how many yards flannel $\frac{7}{8}$ yards wide will line it?

Ans. $10\frac{1}{2}$ yards.

The Double Rule of Three in Vulgar Fractions.

RULE.—Prepare the terms when necessary, then proceed according to the general rule, (page 70), or,

Invert the dividing terms, and multiply the upper figures continually for the numerator, and those below for the denominator of the fractional answer, which divide as the tenor of the question may require.

Examples.

1. If $\frac{3}{4}$ yard of Sattin that is $\frac{7}{8}$ yd. wide, cost $\pounds\frac{2}{3}$, what is the value of $\frac{5}{8}$ yard, that is $1\frac{1}{2}$ yards wide, both of same quality.

$$\begin{array}{l} \text{As } \frac{3}{4} \text{ yd.} \\ \frac{7}{8} \text{ yd.} \end{array} \left\} \pounds\frac{2}{3} \left\{ \begin{array}{l} \frac{5}{8} \text{ yd.} \\ 1\frac{1}{2} \text{ yd.} \end{array} \right.$$

$$\left. \begin{array}{l} \frac{3}{4} \times \frac{7}{8} = \frac{21}{32} \\ \frac{5}{8} \times \frac{7}{4} \times \frac{2}{3} = \frac{70}{120} \end{array} \right\} \frac{70}{120} \div \frac{21}{32} = \frac{224}{36} = \frac{28}{9} = 13s. 4d, \text{ Ans.}$$

Or, $\frac{4}{3} \times \frac{8}{7} \times \frac{5}{8} \times \frac{2}{3} \times \frac{1}{8} \times \frac{7}{4} = \frac{224}{36} = \frac{28}{9} = 13s. 4d. \text{ as before.}$

2. If $\frac{1}{2}$ of 6s. be three shillings, what will $\frac{1}{4}$ of 20 shillings be?

Ans. 7s. 6d.

3. When 12 persons use $1\frac{1}{2}$ lb. of Tea per month, how much will serve a family of 8 persons half a year? *Ans.* $4\frac{1}{2}$ lb.

4. If 9 students spend $\pounds 10\frac{1}{2}$ in 18 days, how much will 20 students spend in 30 days? *Ans.* $\pounds 39 18s. 4d. \frac{20}{9}$.

5. If $\pounds 600$ principal gain $\pounds 33\frac{1}{2}$ interest in $10\frac{1}{2}$ months, in what time will $\pounds 100$ gain $\pounds 6\frac{1}{2}$? *Ans.* 1 year.

6. If the carriage of 60 cwt. 20 miles, cost $\pounds 14\frac{1}{2}$, what weight can I have carried 30 miles for $\pounds 5\frac{1}{2}$? *Ans.* 15 cwt.

7. If $\pounds 100$ in 12 months gain $\pounds 5$ interest, what will $\pounds 60\frac{1}{2}$ gain in $6\frac{1}{2}$ months at the same rate per cent.?

Ans. $\pounds 1. 12s. 9\frac{1}{2}d$

The Single Rule of Three in Decimals.

RULE.—When necessary reduce the fractions to decimals, then work both in direct and inverse proportions, agreeably with those rules in page 79, having regard to placing the points.

Direct Proportion.

Examples.

1. If $\frac{3}{4}$ yard cloth cost £ $\frac{5}{8}$, what will $76\frac{1}{2}$ yards cost ?

$$\begin{array}{r} 5 \overline{) 4.0} \\ .8 \end{array}$$

$$\begin{array}{r} 8 \overline{) 5.000} \\ .625 \end{array}$$

$$\begin{array}{r} 76\frac{1}{2} \\ 4 \end{array}$$

$$3.07$$

$$4 \overline{) 307.00}$$

$$\begin{array}{l} \text{yds.} \\ \text{As } 8 : \end{array}$$

$$\begin{array}{l} \text{£.} \\ .625 \end{array}$$

$$\begin{array}{r} 76.75 \text{ yds.} \\ .625 \end{array}$$

$$\begin{array}{r} 38375 \\ 15350 \\ \hline 46050 \end{array}$$

$$8 \overline{) 4796875}$$

$$\begin{array}{r} 59.9609 \\ 20 \end{array}$$

Answer—£59 19s. 2½d.

$$\begin{array}{r} 19.2180 \\ 12 \end{array}$$

$$2.6160$$

$$4$$

$$2.4640 \text{ Rem.}$$

2. If $\frac{1}{4}$ lb. of Pimento cost $\frac{1}{4}$ of a shilling, what will 278½ lb. cost ? *Ans.* £.83 11s.

7. When $7\frac{1}{2}$ yards cloth are sold for £2 12s. 9d. what will 140½ yards come to ? *Ans.* £47 16s. 3½d.

4. When a Hhd. of Sugar weighing 7 cwt. 2qrs. 14lbs. cost £36 12s. 9d. What is 2 cwt. 1 qr. 2lb. of the same worth ? *Ans.* £11 14s. 2½d.

5. If $\frac{7}{8}$ yard of cloth cost £ $\frac{3}{4}$ what will $146\frac{1}{2}$ yards cost ? *Ans.* £125 11s. 5d.

RULE OF THREE—DECIMALS.

6. If 19 yards of cloth cost 25 dollars 7 dimes 5 cents, what will $435\frac{1}{2}$ yards come to?

Ans. 590 dols. 2d. 1c. 7m. $\frac{1}{16}$.

yds. *D. d. c.*
As 19 : 25. 7 .5 :: 435.5

25.75

21775

30485

21775

8710

D. d. c. m.
19) 11214.125 (590.21 $\frac{7}{16}$

95

171

171

41

38

32

19

135

133

2

7. If I give 12D. 8d. 2c. 5m. for 675 knives, how many knives will 19 mills buy?

dols d c m *yds* *d c m*
As 12. 8 2 5 : 675 :: .019

.019

6075

675

12.825) 12825 (1 knife—*Answer*
12825

.....

8. If 345 yards ribband cost 5 doll. 1 d. 7 c. 5 m. what is that per yard? *Ans.* 1 ct. 5 m.

dol d c m
As 345 yards .. 5. 1 7 5 :: 1 yard.

9. If 675 yards cost 12 doll. 8 d. 2 c. 5 m. how many yards may be purchased for 38 mills? *Ans.* 2 yards.

dol d c m yds c m
As 12. 8 2 5 : 675 :: .3 8 .. 2.

10. What must be paid for $7\frac{1}{2}$ yards of muslin at $5\frac{1}{2}$ dollars per yard? *Ans.* 40 dol. $56\frac{1}{2}$ cts.

11. How does muslin sell per yard, when $7\frac{1}{2}$ yards cost 40 dollars $56\frac{1}{2}$ cents? *Ans.* 5. 5 dol.

12. The French foot is just 1.068 feet American; how tall then would a 6 foot Virginian be in France?

Ans. But 5. 618 feet.

Inverse Proportion.

Examples.

1. What length of a plank, $7\frac{1}{2}$ inches wide, will make a square foot? *Ans.* $19\frac{1}{2}$ feet.

2. If 16 men make a trench in one month 15 days, how many men can perform the same work in 12 days? *Ans.* 56 +

3. How much in length, that is $9\frac{1}{2}$ inches wide, will make a square foot? *Ans.* 14.769 inches.

4. If when wheat is 6s. per bushel, the two penny loaf weigh 9.6 oz. what ought it to weigh, when wheat is 7s. 6d. per bushel? *Ans.* 7 oz. 13 dwt. 14.4 grs.

5. If a plank be .75 feet broad, what length will it require to measure 12 square feet? *Ans.* 16 feet.

6. How much pelong .75 yards wide, will it take to line 25.5 yards of cloth 1.25 yards wide? *Ans.* 42. 5 yards.

Double Rule of Three in Decimals.

RULE.—When necessary prepare the fractions, then work as in whole numbers, placing the points agreeably to the preceding directions.

Examples.

1. If 3 men receive £8.9 for 19.5 days work, how much must 20 men have for 100.25 days work?

As 3 men } £8.9 { 20 men. } *Ans.* £. s. d.
19.5 da. } 100.25 da. } 305. 0. 8.2

2. What will £540.5 gain in .75 of a year at 5 per cent per annum? *Ans.* £.20 5s. 4½d.

3. How many men should mow 417.6 acres in 12 days, when 5 men reap ¼ of that quantity in half the time?

Ans. 20 men.

4. If 16s. 4d. pay the carriage of 5.25 cwt. for 20 miles, what must be paid for the carriage of 17.75 cwt. 7.5 miles?

Ans. £.1 0s. 8½d.

5. If 2 men receive 4s. 7½d. for the labour of one day, how much shall be paid to 4 men for the labour of 10½ days?

Ans. £.4 17s. 1½d.

6. When 12 head of cattle graze down 16¼ acres in 20 days, how much of the like pasture will graze 24 such cattle 100 days?

Ans. 162 a. 2 ro.

Practice.

GENERAL RULE.—1. Take the aliquot parts for the whole price, if under a £. and if above a £. multiply by the number of pounds, and take parts for the shillings, pence, &c.

2. Divide the given quantity by these parts, and add the several quotients together for the answer.

Proof.

By Compound Multiplication, or by the Rule of Three,

Examples.

2327 yards of cloth at 19s. 2½d. *Ans.* £2234 . 17s 9½d.

OPERATION.

<i>s.</i>	10	$\frac{1}{2}$	<i>£.</i>	2327 = value at £1 per yard.	
5		$\frac{1}{2}$	1163 . 10	= Value at 10 <i>s.</i>	per yard.
<i>s d</i>	2.6	$\frac{1}{2}$	581 . 15	= Value at 5 <i>f.</i>	do.
	1.3	$\frac{1}{2}$	290 . 17 . 6	= Value at 2 <i>f.</i> 6 <i>d.</i>	do.
	5	$\frac{1}{2}$	145 . 8 . 9	= Value at 1 <i>f.</i> 3 <i>d.</i>	do.
	$\frac{1}{2}$	$\frac{1}{16}$	48 . 9 . 7	= Value at 0 <i>f.</i> 5 <i>d.</i>	do.
			4 . 16 . 11 $\frac{1}{2}$	= Value at 0 <i>f.</i> 0 $\frac{1}{2}$ <i>d.</i>	do.
<i>Answer</i> — <i>£.</i> 2234 . 17 . 9 $\frac{1}{2}$ = Value at 19 <i>f.</i> 2 $\frac{1}{2}$ <i>d.</i>					

OPERATION BY ANOTHER METHOD.

d.	2	½	shillings.	2327	= Value at 1s. per yard.	
			19			
			20943			
			2327			
			44213	= Value at 19s. per yard.		
½	½		387 . 10	= Value at 2d. per yard.		
			96 . 11½	= Value at ½ per yard.		
			44697 . 9½			
£.2234 . 17 . 9½— <i>Answer as before.</i>						

RULE 1.—When the price is less than a penny, divide by the aliquot parts that are in a penny; then by 12, and 20, it will then shew the answer.

Examples.

$\frac{1}{4}$	$\frac{1}{4}$	5460 lb. at $\frac{1}{4}$.	$\frac{1}{2}$	$\frac{1}{2}$	720	at	$\frac{3}{4}$
12		<u>1365</u>	$\frac{1}{4}$	$\frac{1}{4}$	<u>360</u>		
2 0		11 3 - 9			180		
		<u>£.5 13 9—Ans.</u>	12		<u>540</u>		
			2 0		<u>4 5</u>		
					<u>£.2 5—Ans.</u>		

476	at	$\frac{1}{2}$	<i>Ans.</i>	$\frac{1}{2}$	<i>s.</i>	<i>d.</i>
6547	at	$\frac{3}{4}$	—	0	19	10
9424	at	$\frac{3}{4}$	—	20	9	$2\frac{1}{2}$
			—	29	9	0

RULE 2.—When the price is less than a shilling take the aliquot part or parts that are in a shilling, add them together, and divide by 20 for the answer.

Examples.

$1 \frac{1}{12}$	7546	at	1d.	$1 \frac{1}{12}$	3768	at	$1\frac{1}{2}d.$
2 0	62 8 - 10			$\frac{1}{4}$	$\frac{1}{4}$		
	<u>£31 8 10—Ans.</u>				<u>314</u>		
					78		
				2 0	<u>39 2</u>		
					<u>£.19 12 2</u>		

		<i>d.</i>	<i>Ans.</i>	$\frac{1}{2}$	<i>s.</i>	<i>d.</i>
290	at	$1\frac{1}{2}$	—	1	16	3
429	at	$4\frac{1}{2}$	—	8	0	$10\frac{1}{2}$
616	at	6	—	15	8	0
6211	at	$7\frac{1}{2}$	—	194	1	$10\frac{1}{2}$
102	at	$9\frac{1}{2}$	—	4	0	9
1200	at	$11\frac{3}{4}$	—	58	15	0

RULE 3.—When the price is more than one shilling, and less than two, take the part or parts with so much of the given price as is more than a shilling, which add to the given quantity, and divide by 20, it will give the answer.

Examples.

$\frac{1}{4} \frac{1}{4}$	1684	at $12\frac{1}{4}d.$	$1\frac{1}{2} \frac{1}{4}$	344	at $13\frac{1}{2}d$
	35 - 1			43	
	<u>2 0 171 9 - 1</u>			<u>2 0 38 7</u>	
	<u>£85 19 - 1 Ans.</u>			<u>£19 7 Ans.</u>	

		<i>d.</i>		<i>£.</i>	<i>s.</i>	<i>d.</i>
248	at	14	<i>Answer.</i>	14	9	4
525	at	15	—	32	16	3
310	at	16	—	20	13	4
400	at	$17\frac{1}{2}$	—	29	3	4
317	at	18	—	23	15	6
3002	at	$19\frac{1}{2}$	—	243	18	3
7104	at	$20\frac{1}{2}$	—	606	16	0
626	at	$23\frac{3}{4}$	—	61	18	$11\frac{1}{2}$

RULE 4.—When the price consists of any even number of shillings under 26, multiply the given quantity by half the proposed price, doubling the first figure of the product for shillings, and the rest of the product will be pounds.

Examples.

3750	at	2s.	366	at	4s.
1			2		
<u>£375. 0 Ans.</u>			<u>£73. 4 Ans.</u>		

		<i>s.</i>		<i>£.</i>	<i>s.</i>
422	at	6	<i>Answer</i>	128	14
366	at	8	—	146	8
9642	at	10	—	4821	0
486	at	12	—	291	12
924	at	14	—	646	16
1020	at	16	—	816	0
1621	at	18	—	1458	18
796	at	22	—	875	12

RULE 5.—When the price consists of odd shillings, multiply the given quantity by the price, and divide by 20, the quotient will be the answer.

Examples.

420 at 3s.	360 at 5s.
<u>3</u>	<u>5</u>
20 1260	20 1800
<u>£63 Ans.</u>	<u>£90 Ans.</u>

	s.		£.	s.
1130 at 7		Answer.	395	10
1240 at 9		—	558	0
1355 at 11		—	745	5
1447 at 13		—	940	11
120 at 17		—	102	0
135 at 19		—	128	5

RULE 6.—When the price is 5 shillings, divide the given quantity by four, and if one remains it is 5s. if two it is 10s. if three it is 15s.

Examples.

4)20	at	5s.	4)30	at	5s.
<u>£5</u>	Ans.		<u>£7</u>	10	Ans.
	s.		Answer.	£.	s.
306	at	5		75	0
550	at	5	—	137	10
1683	at	5	—	420	15

RULE 7.—When the price is 10 shillings, take half of the quantity, and if any thing remains it is 10s.

$$\frac{1}{2})1680 \text{ at } 10s.$$

£840 Ans.

$$\frac{1}{2})1161 \text{ at } 10s,$$

£580 10 Ans.

	s.		£.	s.
100 at 1q		Answer.	50	0
131 at 10		—	60	10
1201 at 10		—	600	10
1684 at 10		—	842	0

RULE 8—When the price is shillings and pence, and they the aliquot part of a pound, divide the given sum or quantity by such aliquot part, and it will be the answer at once.—But if not an aliquot part, then multiply by the shillings and take parts for the pence, add them together, and divide by 20 for the answer.

Examples.

$$1s. 8d. \frac{1}{2} 1680 \text{ at } 1s. 8d,$$

£140 Ans.

$$2\frac{1}{2}d. 672 \text{ at } 3s. 2d.$$

3
2016
112

$$2|0)212|8$$

£106 8s. Ans.

	s.	d.	Answer.	£.	s.	d.
426 at 2	6		—	53	5	0
328 at 3	4		—	54	13	4
415 at 4	0		—	83	0	0
313 at 6	8		—	104	6	8
969 at 13	4		—	646	0	0
9292 at 12	6		—	5807	0	0
444 at 15	0		—	333	0	0
2750 at 17	6		—	2406	5	0
646 at 11	4		—	366	1	4
463 at 13	6		—	312	10	6
672 at 19	9		—	663	12	0

RULE 9.—When the price is pounds, shillings, pence and farthings, multiply by the pounds, and take parts for the shillings, pence and farthings, the product will be the answer.

Examples.

10f. $\frac{1}{2}$ 120 at £2 14 0

$$\begin{array}{r} 2 \\ \hline 240 \\ 60 \\ \hline 4 \frac{1}{2} 24 \\ \hline \text{£}304 \text{ Ans.} \end{array}$$

10f. $\frac{1}{2}$ 424 at £4 12 6

$$\begin{array}{r} 4 \\ \hline 1696 \\ 212 \\ \hline 53 \\ \hline \text{£}1061 \text{ Ans.} \end{array}$$

	£.	s.	d.	Answer.	£.	s.	d.
240 at	2	15	0	=	660	0	0
444 at	2	17	0	=	1265	8	0
040 at	3	16	0	=	2432	0	0
340 at	4	10	6	=	1538	10	0
326 at	5	19	11	=	1954	12	10
96 at	6	15	11 $\frac{3}{4}$	=	652	14	0
428 at	3	4	6 $\frac{1}{2}$	=	1381	3	10
28 at	11	14	0	=	327	12	0
458 at	14	17	9 $\frac{1}{2}$	=	6819	8	7
157 at	3	6	8	=	523	6	8
38 at	5	13	0	=	214	14	0

RULE 10.—When the price and quantity given are of several denominations, multiply the price by the integers—and take parts with the parts of the integers for the rest.

Examples.

26 cwt. 2 qrs. 14 lbs. of Sugar at £.3 17s. 6d

$$\begin{array}{r} 3 \quad 17 \quad 6 \\ \hline 5 \\ \hline 19 \quad 7 \quad 6 \\ \hline 5 \\ \hline 96 \quad 17 \quad 6 \\ 2\frac{1}{2} \text{ qrs. } 3 \quad 17 \quad 6 \\ 14\frac{1}{4} \text{ lb. } 1 \quad 18 \quad 9 \\ \hline 9 \quad 8\frac{1}{4} \\ \hline \text{£.}103 \quad 3 \quad 5\frac{1}{4} \text{—Ans.} \end{array}$$

cwt.	qr.	lbs.		£.	s.	d.	Ans.	£.	s.	d.
18	3	19	at	2	2	6	Ans.	40	4	0 $\frac{3}{4}$
13	2	14	at	3	14	0	—	50	8	3
38	2	14	at	7	10	9	—	291	2	8 $\frac{1}{2}$
9	2	26	at	4	10	4 $\frac{1}{2}$	—	43	19	6
6	2	10	at	2	18	6 $\frac{1}{2}$	—	19	5	8 $\frac{3}{4}$
60	1	14	at	1	8	7	—	86	5	8 $\frac{1}{2}$
56	1	17	at	2	15	9	—	157	4	4 $\frac{1}{4}$

RULE 11.—When the price is an even number of shillings, to find what quantity of any proposed article may be purchased for a certain sum of money, annex a cypher to the money, and divide by half the price.

Examples.

How many gallons of wine may be bought with £.66 at 6s. per gallon?

$$\begin{array}{r} 3 \overline{)660} \\ \underline{220} \text{ Ans.} \end{array}$$

How many bushels of wheat at 8s. per bushel, may be bought with £90? *Ans.* 225.

How many yards of cloth may be purchased with £200 at 12s. per yard? *Ans.* 333 $\frac{1}{3}$.

How many pounds of tea may be purchased with £2000 at 14s. per pound? *Ans.* 2857 $\frac{1}{2}$ lbs.

How many yards of cloth can I purchase with £700 at 24s. per yard? *Ans.* 583 $\frac{1}{3}$.

Practical Questions.

			£.	s.	d.	Ans.	£.	s.	d.
1	942g	at	0	0	0 $\frac{3}{4}$	Ans.	29	9	0 $\frac{3}{4}$
2	7812 $\frac{1}{2}$	at	0	0	3 $\frac{1}{4}$	=	122	1	4 $\frac{3}{4}$
3	649 $\frac{1}{4}$	at	0	0	10	=	27	1	0 $\frac{1}{2}$
4	686 $\frac{3}{4}$	at	0	1	1 $\frac{1}{2}$	=	38	12	7
5	649 $\frac{1}{2}$	at	0	1	11	=	62	5	4 $\frac{1}{4}$
6	528 $\frac{1}{2}$	at	0	12	0	=	317	2	0
7	601 $\frac{1}{2}$	at	0	13	0	=	390	19	6
8	248	at	0	16	5 $\frac{1}{2}$	=	204	1	8
9	67 $\frac{1}{2}$ yards	at	0	12	2	=	41	1	3
10	64 $\frac{1}{4}$ do.	at	0	8	1	=	27	11	8 $\frac{1}{4}$
11	91 $\frac{1}{2}$ do.	at	2	2	0	=	192	3	0

			£.	s.	d.		£.	s.	d.
12	108½	do. at	5	5	0	=	569	12	6
13	132½	pieces at	7	0	0	=	925	15	0
14	2000	do. at	12	19	11½	=	25995	16	8
15	4000	do. at	6	9	11½	=	25995	16	8
16	94	do. at	6	6	8	=	595	6	8
17	209½	galls. at	0	5	9½	=	60	14	9½
18	405½	do. at	0	3	9	=	76	1	6½
19	139	do. at	0	6	8	=	46	6	8
20	799½	do. at	0	13	4	=	533	0	0
21	327	tuns at	3	4	6½	=	1377	19	3½
22	79	do. at	6	13	4	=	526	13	4
23	48	do. at	3	3	4	=	152	0	0
24	500	do. at	12	19	11½	=	6498	19	2
25	1000	do. at	6	9	11½	=	6498	19	2

26 Bought 27 cwt. 2 qrs. 15 lbs. of Raisins, at £.1 1s.
4d. per cwt. what was the amount?

Answer—£.29 9s. 6½d.

27 Sold fifty-six cwt. 1 qr. 17 lbs. of Sugar, at £.2 15s.
9d. per cwt. what does it come to?

Ans.—£.157 4s. 4½d.

28 Bought 98 cwt. 0 qr. 15 lbs. of Tobacco at £.3 17s.
10d. per cwt. what had I to pay?

Ans.—£.381 18s. 1d.

29 How many bushels of wheat may be bought with £.450 at
6s. per bushel?

Ans. 1500 bushels.

Advance and Discount.

Aliquot or even parts of 100 Pounds.

£.	pr. cent.				
2½	-	¼	45	-	9
5	-	½	47½	-	10
7½	-	¾	50	-	10
10	-	1	53⅓	-	11
12½	-	1¼	55	-	11
15	-	1½	60	-	12
17½	-	1¾	62½	-	13
20	-	2	66⅔	-	14
22½	-	2¼	70	-	15
25	-	2½	75	-	16
30	-	3	80	-	17
31½	-	3¼	82½	-	18
33½	-	3½	83⅓	-	19
37½	-	3¾	85	-	20
40	-	4	87½	-	21
43½	-	4¾	90	-	22

To Lay on Per Cent, (which means the Advance.)

RULE 1.—Multiply the given sum by the upper figure of the fraction, and divide by the lower, against the rate per cent. proposed to be laid, add the product to the given sum, and you have the answer—or,

2. As £100 is to £100 with the per cent. added, so is the given sum to the amount.

To take off per cent (which means the Discount.)

RULE 1.—Multiply by the upper figure or figures of the fraction in the table, add the upper and lower figures of the said fraction together for a divisor, by which divide; then subtract the quotient from the given sum, the remainder will be the answer—or,

2. As £100 with the per cent. added, is to £100, so is the given sum to the answer.

Examples.

1. Lay 2½ per cent on £.800 10s.

$$2\frac{1}{2} \text{ is } \frac{1}{40}) 800 \text{ 10} \\ \underline{20 \quad 0 \quad 3}$$

£.820 10 3 Ans.

- | | |
|--|------------------------------|
| 2. Lay 5 p ct. on £37 10s. | <i>Ans.</i> £39 7s. 6d. |
| 3. Lay 10 p ct. on £46 10s. 6d. | <i>Ans.</i> £51 3s. 6½d. ⅔ |
| 4. Lay 12½ p ct. on \$846 24 cts. | <i>Ans.</i> \$952.2 cts. |
| 5. Lay 20 p ct. on £157 17s. 6d. | <i>Ans.</i> £189 9s. |
| 6. Lay 25 p ct. on £350 10s. | <i>Ans.</i> £438 2s. 6d. |
| 7. Lay 30 p ct. on \$3000 50 cts. | <i>Ans.</i> \$3900 65 cts. |
| 8. Lay 33⅓ p ct. on £372 12s. 6d. | <i>Ans.</i> £496 16s. 8d. |
| 9. Lay 27½ p ct. on £700 | <i>Ans.</i> £892 10s. |
| 10. Lay 45 p ct. on £955 18s. 9d. | <i>Ans.</i> £1386 2s. 2½d. |
| 11. Lay 50 p ct. on £306 17s. 6d. | <i>Ans.</i> £460 6s. 3d. |
| 12. Lay 47½ p ct. on £997 14s. 6d. | <i>Ans.</i> £1471 12s. 10½d. |
| 13. Lay 40 p ct. on 4000 dolls. | <i>Ans.</i> 5615 dollars. |
| 14. Lay 60 p ct. on 400 dolls. 50 cts. | <i>Ans.</i> 640 dls. 80 cts. |
| 15. Lay 66⅔ p ct. on £570 18s. 11d. | <i>Ans.</i> £951 11s. 6½d. |
| 16. Lay 70 p ct. on \$940 50 cts. | <i>Ans.</i> \$1598 85 cts. |
| 17. Lay 75 p ct. on \$1635 40 cts. | <i>Ans.</i> 2861 95 cts. |
| 18. Lay 80 p ct. on \$300. | <i>Ans.</i> \$540. |
| 19. Lay 87½ p ct. on £1 10s. 6d. | <i>Ans.</i> £2 17s. 2½d. |
| 20. Lay 90 p ct. on £702 12s. 6d. | <i>Ans.</i> £1334 19s. 9d. |

21. From $\begin{matrix} \text{£.} & \text{s.} & \text{d.} \\ 750 & 10 & 6 \end{matrix}$ take five per cent?

$$\begin{array}{r} \frac{1}{20} + 1. \quad 21)750 \quad 10 \quad 6 \\ \underline{35 \quad 14 \quad 9\frac{1}{2} \quad \frac{1}{2}} \\ \underline{\underline{\text{£}714 \quad 15 \quad 8\frac{1}{2} \quad \frac{6}{2}}} \end{array}$$

- | | |
|--|--------------------------|
| 22. Take 10 p ct. off of £100. | <i>Ans.</i> 90 18 2½ ⅔ |
| 23. From £1175 18s. 7½d. take 20 p ct. | <i>Ans.</i> 979 18 10½ ¼ |
| 24. From £40 16s. 6d. take 25 p ct. | <i>Ans.</i> 32 13 2½ ⅓ |
| 25. From £150 16s. 6d. take 33⅓ p ct. | <i>Ans.</i> 112 17 10½ ⅔ |
| 26. From £160 take 75 p ct. | <i>Ans.</i> 91 8 6⅔ |

Practical Questions.

1. Lay 15 per cent on £300 10s. 6d.
Ans. £390 13s. 7¾d. ⅔.
2. Advance 37½ per cent on a bill amounting to £560 13s. 4d.
Ans. £770 18s. 4d.
3. Advance 100 per cent on an invoice amounting to £136 16s. 8½d.
Ans. £273 13s. 4½d.
4. If 83⅓ per cent be laid on a bill amounting to £90 16s. 6d. what will be its value?
Ans. £166 10s. 3d.

5. If a merchant sells me goods amounting to £60 17s. 6d. and discounts $12\frac{1}{2}$ per cent. what sum shall I have to pay?

Ans. £54 2s. 2½d. $\frac{6}{9}$.

6. What shall I have to pay on an invoice amounting to 600 dols. 50 cents, when there is a discount made of 30 per cent?

Ans. 461 dols. 92 c. 3 m. $\frac{1}{11}$.

Tare and Trett.

TARE AND TRETT are allowances made by the seller to the purchaser, on a variety of commodities.

TARE is the weight of the barrel, box, or whatever contains the goods; and is either,

1. At so much per barrel, bag, &c.
2. At so much per Hundred weight, or,
3. At so much in the whole gross weight.

TRETT is an allowance for waste and dust of 4lb. per 104.

GROSS is the whole weight of any sort of goods together with the box, barrel, or whatever else contains them.

SUTTLE is when part of the allowance is deducted from the gross.

NETT WEIGHT is what remains after all allowances are made.

When the Tare is so much per barrel, box, bag, &c.

RULE.—Multiply the number of barrels, boxes, &c. by the tare, and subtract the product from the gross, the remainder will be nett.

Examples.

1. In 14 hhds. of Sugar, weighing together 89 cwt. 3 qrs. 17 lbs. gross; tare per hhd. 100 lbs. what nett weight?

		cwt.	q.	lb.
14		89	3	17 gross
100	.	12	2	0 tare
28)	1400	77	1	17 nett, <i>Answer</i>
4)	50			
	12 Cwt. 2 qr.			

2. In 16 Hhds of Tobacco each weighing gross, 5cwt. 1qr. 19lb. tare per hhd. 100 lbs. what is the nett weight?

Ans. 72 cwt. 1 qr. 20lb.

When the Tare is at so much per Hundred Weight,

RULE.—Divide the gross weight by the aliquot parts of a cwt. subtract the quotient from the gross, the remainder will be nett.

Examples.

1. What is the nett weight of 12 barrels of Argol, gross 48 cwt. 2qr. 16lb, tare 14lb. per cwt.

	cwt.	qr.	lb.
14lb. is $\frac{1}{8}$	48	2	16
	6	0	9 tare
	42	2	7 nett <i>Ans.</i>

2. What is the nett weight 30 boxes Figs, each 2 cwt 3q. gross; tare per cwt. 14lb. *Ans.* 72 cwt. 0qr. 21lb.

3. What is the nett produce of 17 barrels Pot-Ash, each 203lb. gross, tare 10lb. per cwt. *Ans.* 3142lb. 14 oz.

When the Tare is so much in the whole gross weight.

RULE.—Subtract the tare from the gross, the remainder will be nett.

Examples.

1. In 3 Hhds. of Sugar weighing together 17 cwt. 3q. 19lb. gross, tare in the whole, 2 cwt. 1qr. 10lb. what is the nett weight.

	cwt.	qr.	lb.
	17	3	19
	2	1	10
<i>Answer.</i>	15	2	9 nett.

2. What is the nett weight of 38 Hhds. Tobacco weighing together, 201 cwt. 3qrs. 12lb. gross; tare in the whole 3140lb.

Ans. 173 cwt. 3qr. 8lb.

When Trett is allowed with Tare.

RULE.—Divide the futtle weight by 26, and the quotient will be the trett, which subtract from the futtle the remainder will be nett.

AMERICAN DUTIES.

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Examples.

1. In 177 cwt. 0 qrs. 22 lbs. Gross; Tare 9 lb. per hundred weight, and Trett 4 lbs. per 104 lbs. how many pounds nett?

cwt.	qrs.	lb.		cwt.	qr.	lb.
177	0	22	Gross.			
		9				
112)	1594	3	2	14	0	26 Tare.
	112					
	474					
	448					
	26					
	4					
112)	107	0				
	28					
	858					
	214					
112)	2998	26				
	224					
	758					
	672					
	86					

	177	0	22
	14	0	26 tare.
lbs.			
4 is $\frac{1}{16}$)	162	3	24
	6	1	2 trett.
	Ans.	156	2 22 nett.

2. In 247 cwt. 2 qrs. 15 lbs. Gross; Tare 28 lb. per cwt. and Trett 4 pounds per 104 pounds; what nett weight?

Ans. 178 cwt. 2 qr. 9 lb. 4 oz.

Valuation of American Duties.

RULE 1.—Reduce the commodity to the lowest denomination mentioned in the duties, then multiply by the duty; the product is the answer.

2. If the duty is expressed ad valorem, (which means at a certain rate per cent on the whole value) multiply the whole value by the duty, and divide the product by 100.

AMERICAN DUTIES.

Examples.

1. What is the duty on 16 ^{cwt. qr. lb.} 14 of Pimento at 1 cent per pound?

$$\begin{array}{r} 4 \\ \hline 65 \\ 28 \\ \hline 524 \\ 131 \\ \hline \end{array}$$

1834 cents = 18 dol. 34 cts.

2. What is the duty on 5 cwt. 3 qrs. 8 lbs. of Sugar at 2 cents per pound?

$$\begin{array}{r} \text{cwt. qr. lb.} \\ 5 \quad 3 \quad 8 \\ 4 \\ \hline 23 \\ 28 \\ \hline 192 \\ 46 \\ \hline 652 \text{ lbs.} \\ 2\frac{1}{2} \text{ duty.} \\ \hline 1304 \\ 326 \\ \hline \end{array}$$

Ans. 1630 cents = 16 dol. 30 cts.

3. What is the duty on 820 dozen of Porter at 20 cents per dozen? *Ans.* 164 dollars.

4. Calculate the duty on 570 pair of shoes at 10 cents per pair? *Ans.* 57 dollars.

5. What is the duty on 2 cwt. 2qr. 12lb. Coffee at $3\frac{1}{2}$ cents per lb. *Ans.* 10dols. 24 cts.

6. What duty must be paid on 120 hhds. Molasses at 20 cts. per gallon. *Ans.* 1512 dols.

7. What is the duty on goods valued at 800 dollars at 12 per cent. *Ans.* 96 dols.

8. What is the duty on goods valued at 400 dols. 20 cents at $6\frac{1}{2}$ per cent. *Ans.* 26 dols. $1\frac{1}{2}$ cent.

9. What is the duty on goods valued at 900 dols. 50 cts. at $12\frac{1}{2}$ per cent. *Ans.* 112 dols. $56\frac{1}{2}$ cts.

11q

10. Calculate the duty on 200 dozen pair of shoes at 50 cts. per dozen. *Ans.* 100 dols.
11. What duty must be paid on 100 tierces of Malaga wine at 9 cents per gallon? *Ans.* 378 dols.
12. What is the duty on 60 cwt. of Cable at 75 cts. per cwt. *Ans.* 45 dols.
13. How many dollars will pay the duty on a chariot valued at 300 guineas (English) at 15 per cent. *Ans.* 210 dols.

INTEREST is a consideration allowed by the borrower of any sum of money to the lender, according to a certain rate per cent. agreed on, which by law is stated at 6, that is, 6 for the use of £100 for one year.

RATE is the sum per cent. agreed on.

INTEREST is of two kinds, Simple and Compound.

SIMPLE INTEREST is that which arises from the principal only.

General Rule.

1. Multiply the principal by the rate per cent., and divide the product by 100, (or, which is the same, cut-off two right hand figures in the pounds, which must be reduced to the lowest denomination each time cutting off as at first) the quotient will be the answer for one year.
2. When the question is for more than one year, multiply the interest of one year by the number of years.
3. If there be parts of a year, as months, or days, work for the months by the aliquot parts of a year; and for the days by the aliquot parts of a month.

NOTE.—When the rate pr. cent. per annum, is

£.

9		Multiply the Principal by		3		of the given num- ber of months, en- ting off, as before directed, and you will have the inter- est for the given time.
8				4		
6				2		
4				3		
3				1		
2				8		
				6		

SIMPLE INTEREST.

2. What is the interest of £300 19s. 9d. for 3 years, 10 months, 15 days, at $7\frac{1}{2}$ per cent?

$\frac{1}{2}$	$\frac{1}{2}$	£.	s.	d.	
		300	19	9	Principal.
				$7\frac{1}{2}$	Rate p. cent.
		2106	18	3	
		150	9	$10\frac{1}{2}$	
		22.57	8	$1\frac{1}{2}$	
		20			
		11.48			
		12			
		5.77			
		4			
		3.10			

mo.	$\frac{1}{2}$	£.	s.	d.	
6		22	11	$5\frac{1}{4}$	= Interest for one year.
				3	
		67	14	$5\frac{1}{4}$	= do. — 3 years
3	$\frac{1}{2}$	11	5	$8\frac{3}{4}$	= do. — 6 months
1	$\frac{1}{2}$	5	12	$10\frac{1}{4}$	= do. — 3 do.
da.					
15	$\frac{1}{2}$	1	17	$7\frac{1}{2}$	= do. — 1 do.
			18	$9\frac{3}{4}$	= do. — 15 days
		£87	9	$5\frac{1}{2}$	Answer.

3. What is the interest of £565 18s. 4d. for one year and six months at 5 per cent per annum?

£.	s.	d.	
565	18	4	
		5	
28.29	11	8	
	20		
	5.91		
	12		
	11.00		

$\frac{1}{2}$	£.	s.	d.	
6	28	5	11	Interest for one year.
	14	2	$11\frac{1}{2}$	do. for 6 months.
	£42	8	$10\frac{1}{2}$	Answer.

OPERATION BY ANOTHER METHOD.

		$\pounds$.	s.	d.	
5 p. ct.	$\frac{1}{20}$	565	18	4	
6 mo.	$\frac{1}{2}$	28	5	11	= Interest for one year.
		14	2	11 $\frac{1}{2}$	= do. for 6 months.
<u><u>£42 8 10$\frac{1}{2}$ Answer.</u></u>					

4. What is the interest of £169 19s. 11d. for 6 months at 6 per cent per annum?

$\pounds$.	s.	d.	
169	19	11	
			3 = $\frac{1}{2}$ the number of months.
5.09	19	9	
			20
1.89			
			12
11.97			
			4
3.88			
$\pounds$.	s.	d.	Ans.
5	1	11 $\frac{1}{2}$	

5. What is the interest of £1640 16s. 8 $\frac{1}{2}$ d. for 15 months at 8 per cent per annum?

$\pounds$.	s.	d.	
1640	16	8 $\frac{1}{2}$	
			10 = $\frac{2}{3}$ the number of months.
164.08	7	1	
			20
1.67			
			12
8.05			
$\pounds$.	s.	d.	Ans.
164	1	8	

6. What is the interest of £352 12s. 6 $\frac{1}{2}$ d. for 15 months at 4 per cent per annum?

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SIMPLE INTEREST.

£.	s.	d.	
352	12	$6\frac{1}{2}$	
			$5 = \frac{1}{3}$ the number of months.
17.63	2	$6\frac{1}{2}$	
			20
12.62			
			12
7.52			
			4
2.10			

£.	s.	d.	
17	12	$7\frac{1}{2}$	Ans.

7. What is the interest of 169 dollars 48 cents for eighteen months at 6 per cent per annum?

dols.	cts.	
169	48	
		$9 = \frac{1}{2}$ the number of months.

Ans. 15.25.32 Interest in cents and parts of a cent for 18 months,

By cutting off two more figures (viz. 25) from the cents, gives the answer in dollars and cents = 15 dollars, 25 cents,
 $\frac{32}{100}$

8. What is the interest of 1200 dollars, 16 cents, for sixteen months, at 9 per cent per annum?

cents.	
120016	
$12 = \frac{3}{4}$ the number of months	
144.01.92	
144 dol. 1 ct. $\frac{92}{100}$	Answer.

9. What is the interest of 3120 dollars, 40 cents, for 3 years, 7 months and 15 days, at $6\frac{1}{2}$ per cent per annum?

SIMPLE INTEREST.

123

		\$12040	Principal.		312040
		6 $\frac{1}{2}$	Rate per cent.		7
		1872240			\$)2184280
		273035	value of $\frac{1}{4}$.		
					273035 value $\frac{1}{4}$.
	1 00	21452 75	The 75 cut off are equal to $\frac{3}{4}$ of a cent.		
mo.	6	$\frac{1}{2}$ 21452.75	Interest in cents for one year.		
		3			
		64358.25	do. for 3 years.		
1	$\frac{1}{2}$	10726.37	do. — 6 months.		
du.					
15	$\frac{1}{2}$	1787.39	do. — 1 do.		
		893.69	do. — 15 days.		
		77765.70	Interest in cents, &c. for the whole time.		
		777 dollars, 65 cents, $\frac{70}{100}$	Answer.		

In all questions of the above nature, where dollars and cents are concerned, it is easiest to work with cents, as in the preceding example; it is only necessary to cut off two right hand figures with a dot or point, which two figures are parts of a cent—The figures so cut off are to be multiplied, divided, added, &c. in the same manner as whole numbers, taking care to let the points stand exactly under one another; when the work is finished, the two right hand figures may be rejected as the 70 in the preceding operation, being only parts of a cent and of little value, two more figures being cut off produces the answer in dollars and cents.

10. What is the interest of £216 19s. 6d. for one year 4 months at 5 per cent per annum? *Ans. £14 9s. 3 $\frac{1}{2}$ d.*

11. What interest is due on a legacy of £500 for 16 years, 6 months and 15 days, at 6 per cent? *Ans. £496 5s.*

12. What sum will £375 12s. 2d. amount to in 2 years, 3 months and 10 days, at 4 per cent per annum? *Ans. £410 1s. 10 $\frac{1}{2}$ d.*

13. What is the interest of 7000 dollars, 10 cents, for 4 years and 9 months, at 6 per cent per annum? *Ans. 1995 dols. 2 cts. $\frac{85}{100}$ d.*

14. What sum will a bond of 1000 dollars and 20 cents amount to in 5 years, 6 months and 10 days, at 5 per cent? *Ans. 1276 dols. 54 cents.*

15. At 6 per cent per annum, what will be the interest of £674 13s. 8½d. for 5 years, 11 months and 28 days?

Ans. £242 13s. 1½d.

16. What is the interest of £216 19s. 6d. for 16 months, at 6 per cent per annum?

Ans. £17 7s. 1½d.

17. What interest is due on a legacy of £573 13s. 9½d. for 6 years and 6 months, at 6 per cent per annum?

Ans. £223 14s. 8½d.

18. What sum will a bond of £329 17s. 6½d. amount to in 3 years, 7 months and 12 days, at 5 per cent per annum?

Ans. £389 10s. 6½d.

19. What sum will £439 12s. 9½d. amount to in sixteen months at 6 per cent per annum?

Ans. £474 16s. 4½d.

20. Required the interest of a bond of £347 7s. 5½d. for 15 months, at 6 per cent per annum?

Ans. £26 1s. 0½d.

A short mode of calculating interest at six per cent per annum, on Virginia currency, the product to be in dollars and cents.

RULE.—Reduce the pounds into shillings, cut off the two right hand figures; those on the left will be the answer in dollars; those on the right in cents.

Examples.

1. What is the interest of £2000 for one year and six months?

£.
2000
20

6 mos. is $\frac{1}{2}$ 400 00 Interest in cents for one year.

200 00 do. do. six months.

600 00 cents = 600 dolls. *Ans.*

2. What is the interest of £1875 17s. for one year.

£. s.
1875 17
20

375 17 cents = 375 doll. 17 cents—*Ans.*

3. What is the interest of £13 18s. for one year?
Ans. 2 dols. 78 cts.
 4. Calculate the interest of £47 10s. for one year and six months?
Ans. 13 dols. 25 cts.
 5. What is the interest of £963 11s. for one year and 3 months?
Ans. 240 dols. 88 cents.
 6. What is the interest of £1272 10s. for 3 years and 4 months?
Ans. 848 dols. 33½ cents.

NOTE.—By the above, it appears obvious that the interest on a shilling at 6 per cent for one year is one cent; so that all sums may be ascertained with great ease and facility. For example, 30 shillings is 30 cents, 100 shillings is 100 cents = 1 dollar, &c. &c.

A short method by which the interest of any given sum in dollars and cents, for any given number of days, may be found.

RULE.—Halve the number of days, and take the aliquot parts of a month, which divided in the sum will give the interest in cents; or, halve the sum and divide the product by the days.

Examples.

1. What is the interest of 169 dollars 48 cents, for 15 days, at 6 per cent per annum?

½ of 15 days is 7½ which is ¼ of a month, ¼)169 48

42 cts. $\frac{37}{100}$ Ans.

Or thus:

$$\frac{1}{2})169\ 48$$

$$15\ \text{days is } \frac{1}{2})\ 84\ 74$$

42 cts. $\frac{37}{100}$ Answer.

2. What is the interest of 400 dollars and 20 cents for 20 days at 6 per cent per annum? *Ans.* 1 dol. 33 cts. $\frac{40}{100}$.
 3. What is the interest of 763 dollars 74 cents for 10 days, at 6 per cent per annum? *Ans.* 1 dol. 27 cts. $\frac{30}{100}$.
 4. What is the interest due on 300 dollars 50 cents, when it has been on demand 24 days, at 6 per cent?
Ans. 1 dol. 20 cts. $\frac{30}{100}$

$$\begin{array}{r}
 \text{£.} \\
 725 \\
 \underline{500} \\
 \text{As £500 .. £225 :: £100} \\
 \underline{100} \\
 5 \overline{) 00} 225 \overline{) 00} \\
 \underline{9} 45
 \end{array}$$

Answer 5 per cent.

2. At what rate per cent will £350 amount to £402 10s. in 5 years time? *Ans.* 3 p. cent.

To find the time, when the principal, amount, and rate per cent are given.

RULE.—Divide the whole interest by that of the principal for one year, and the quotient will be the answer.

Examples.

1. In what time will £500 amount to £725, at 5 per cent per annum?

$$\begin{array}{r}
 \text{£.} \\
 500 \\
 \underline{5} \\
 25 \overline{) 00}
 \end{array}
 \qquad
 \begin{array}{r}
 \text{£.} \\
 725 \\
 \underline{500} \\
 25 \overline{) 225} 9 \text{ years } \textit{Ans.} \\
 \underline{225}
 \end{array}$$

2. In what time will £350 amount to £402 10s. at 3 per cent per annum? *Ans.* 5 years.

Commission.

Commission is an allowance made to factors, correspondents, &c. at a stipulated rate per cent.

RULE.—Multiply the given sum by the rate per cent as in Simple Interest, and for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, take the part or parts from the given sum, which add to the product, and divide by 100 for the answer.

BROKAGE.

Examples.

1. What must I allow my correspondent for disbursing on my account £400 10s. at $2\frac{1}{4}$ per cent?

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \\
 400 \quad 10 \quad 2\frac{1}{4} \\
 \hline
 801 \quad 0 \\
 100 \quad 2 \quad 6 \\
 \hline
 9.01 \quad 2 \quad 6 \\
 20 \\
 \hline
 0.22 \\
 12 \\
 \hline
 2.70 \\
 4 \\
 \hline
 2.80 \\
 \hline
 \end{array}
 \quad \text{£9 os. } 2\frac{1}{2}\text{d. Ans.}$$

2. What must I allow a factor when he has sold goods to the value of 888l. 8s. $9\frac{1}{2}$ d. at $2\frac{1}{2}$ p. ct.? *Ans. £22 4s. $2\frac{1}{2}$ d.*

3. My correspondent writes me word that he has bought goods on my account to the value of 600l. 12s. 8d. what may he demand for commission at five per cent?

Ans. £30 0s. $7\frac{1}{2}$ d.

4. If I allow my factor $3\frac{3}{4}$ per cent for commission, what may he demand for the laying out 500l. 6s. 8d.

Ans. £18 15s. 3d.

5. What is commission of £750 16s. 8d. at $12\frac{1}{4}$ per cent.

Ans. £93 17s. 1d.

Brokage.

Brokage is an allowance made to Brokers and others for assisting merchants, &c. in the purchase and sale of commodities.

RULE.—Divide the sum given by 100. (in doing which it is only necessary to point off the two right hand figures of the sum given in pounds) and take parts from the quotient, with the rate per cent.

Examples.

1. If a merchant employ a broker to sell goods for him to the value of £5500 15s. 10d. what is the brokage at 4s. per cent.

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \quad \text{d.} \\
 55.00 \quad 15 \quad 10 \\
 \underline{20} \\
 0.15 \\
 \underline{12} \\
 1.90 \\
 \underline{4} \\
 3.60
 \end{array}$$

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \quad \text{d.} \\
 4s. \quad \frac{1}{2} \quad 55 \quad 0 \quad 1\frac{1}{2} \\
 \hline
 \text{£}11 \quad 0 \quad 0\frac{1}{2} \quad \frac{3}{4} \quad \text{Ans.}
 \end{array}$$

2. What is the Brokage of £760 10 6d. at 6 per cent.

Ans. £2 5s 7½d.

3. If I employ a broker to purchase goods for me amounting to £1260 10s 4d what may he charge for brokage at 6s 6d per cent.

Ans. £4 1s 11d.

4. What is the brokage of £50 10s at 10s per cent.

Ans. 5s 0½d.

5. What is the brokage of £670 16s 6½d at 7s 6d per cent.

Ans. £2 10s 3¼d.

Compound Interest.

COMPOUND INTEREST is so called in consequence of the interest becoming part of the principal.

RULE.—Find the interest of a year, and add it to the principal, which call the amount for the first year; find the interest of this amount which add as before, for the amount of the second year, and so on for any number of years—From the last amount, take the given principal, and the remainder will be the compound interest.

NOTE.—To find the Compound Interest for odd months, days, &c. find the interest for one year more than required, and take parts for the odd time out of that year, the product of which, add to the last amount—It will be the compound interest for the whole time.

COMPOUND INTEREST.

Examples.

1. What is the Compound Interest of £50 10s 6d for 2 years and 6 months, at 5 per cent. per annum?

5 per cent.	$\frac{1}{20}$	£.	s.	d.	
		50	10	6	principal.
		2	10	$6\frac{1}{2}$	interest 1st year.
5 —	$\frac{1}{20}$	53	1	$0\frac{1}{2}$	amount 1st do.
		2	13	$0\frac{1}{2}$	interest 2d do.
5 —	$\frac{1}{20}$	55	14	1	amount 2d do.
6 months	$\frac{1}{4}$	2	15	$8\frac{1}{4}$	interest 3d do.
		1	7	10	interest for 6 months.
add		55	14	1	amount 2d year.
		57	1	11	ditto. for the whole time.
subtract		50	10	6	given principal.
Ans.		£7	11	5	Compound Interest.

2. What is the compound interest of 8200 dollars 20 cents, that has been due 3 years, 7 months and 15 days, at 6 per ct. per annum?

5 p. cent.	$\frac{1}{20}$	820020	Principal in cents.
1 —	$\frac{1}{5}$	41001	
		8200	
5 —	$\frac{1}{20}$	869221	Amount first year.
1 —	$\frac{1}{5}$	43461	
		8692	
5 —	$\frac{1}{20}$	921374	do, 2d do.
1 —	$\frac{1}{5}$	46068	
		9213	
5 —	$\frac{1}{20}$	976655	do. 3d do.
1 —	$\frac{1}{5}$	48832	
		9766	
6 months.	$\frac{1}{2}$	58598	Interest 4th do.
1 —	$\frac{1}{6}$	29299	
15 days.	$\frac{1}{12}$	4883	
		2441	
Add		36623	do. 7 months, 15 days.
		976655	Amount 4th year.
		1013278	do. 3 years, 7 months, 15 days.
Subtract		820020	First principal.
		193258	Compound Interest in cents.
		1932	dols. 58 cents. —Answer.

3. What is the compound interest of £259 10s. for 3 years, 9 months and 15 days at $4\frac{1}{2}$ per cent per annum?

Ans. £47 3s. 6 $\frac{1}{2}$ d.

4. What will 528 dollars 75 cents amount to in 4 years 7 months, at 5 per cent per annum, compound interest?

Ans. 661 dolls. 40 cents.

Purchasing of Stocks.

Stock is a general name for the capitals of trading companies, banks, &c. and the buying and selling specified sums of money in those funds have become very common.

RULE.—Multiply the sum to be purchased by the excess, above 100; divide the product by 100, or dot off two right hand figures as in Interest; the product of the operation added to the given sum, is the purchase required.

If under par (that is under 100), multiply by the rate per cent, the product thereof divided by 100, gives the purchase.

Examples.

1. What is the purchase of £575 10s. Virginia bank stock, at $131\frac{1}{2}$ per cent?

$$\begin{array}{r}
 6 \times 5 + 1 = 31. \\
 \begin{array}{r}
 \text{£.} \quad \text{s.} \\
 575 \cdot 10 \\
 \hline
 3453 \cdot 0 \\
 5 \\
 \hline
 17265 \cdot 0 \cdot = 30 \\
 \frac{1}{2} \text{ per cent } \frac{1}{2} \quad 575 \cdot 10 \cdot = 1 \\
 287 \cdot 15 \cdot = \frac{1}{2} \\
 \hline
 181 \cdot 28 \cdot 5 = 31\frac{1}{2} \\
 20 \\
 \hline
 5 \cdot 65 \\
 12 \\
 \hline
 7 \cdot 80 \\
 4 \\
 \hline
 3 \cdot 20 \\
 \hline
 \text{£.} \quad \text{s.} \quad \text{d.} \\
 575 \cdot 10 \cdot 0 \\
 181 \cdot 5 \cdot 7\frac{1}{2} \\
 \hline
 \underline{\underline{£756 \cdot 15 \cdot 7\frac{1}{2}}}
 \end{array}
 \end{array}$$

2. What is the purchase of 4500 dollars 50 cents bank stock, at $132\frac{1}{2}$ per cent?

$$8 \times 4 = 32 \left\} \frac{1}{2} \frac{1}{2} \text{ 4500 50 cents.}$$

$$\begin{array}{r} 4 \\ \hline 1800200 \\ 8 \\ \hline 14401600 = 32 \\ 225025 = \frac{1}{2} \\ \hline 100)1462.66|25 \\ \hline 1462 \text{ dollars, 66 cents } \frac{25}{100} \end{array}$$

$$\begin{array}{r} 4500.50 \\ 1462.66 \frac{25}{100} \\ \hline 5963 \text{ dols. 16 cts. } \frac{25}{100} \text{ Ans.} \end{array}$$

3. What is the purchase of 2500 dollars 75 cents bank stock, at $85\frac{1}{2}$ per cent?

$$\begin{array}{r} 12 \times 7 + 1 = 85. \quad 250075 \\ 7 \\ \hline 1750525 \\ 12 \\ \hline 21006300 = 84 \\ \frac{1}{2} \frac{1}{2} \quad 250075 = 1 \\ \frac{1}{2} \frac{1}{2} \quad 125037 = \frac{1}{2} \\ 62518 = \frac{1}{4} \\ \hline 100)214439|30 = 85\frac{1}{2} \end{array}$$

$$\begin{array}{r} 2144 \text{ dols. 39 cts. } \frac{10}{100} \text{ Ans.} \end{array}$$

4. At $96\frac{1}{2}$ per cent, what is the purchase of £250 10s. bank annuities?

Ans. £241 14s. $7\frac{1}{2}$ d.

5. At $120\frac{1}{4}$ per cent, what is the purchase of £2000 12s. South Sea Stock?

Ans. £2405 14s. 5d.

Policies of Insurance.

Insurance in law and commerce, denotes a contract by which one party engages to pay the other, for a certain premium or consideration, such losses as he may accidentally sustain. The common kind of Insurances are :

1. Against loss at sea ; a most beneficial institution, eminently calculated for promoting the security of trade. It is at present conducted by a regular system of rules, under the immediate sanction of the law, the decisions of courts of justice, and the usage of merchants. There are several societies for this kind of insurance in America, but it would be incompatible with my limits to enter into any details.

2. Against fire ; for which purposes various offices are established in this country, that of Virginia at the city of Richmond, called the Mutual Insurance Society ; together with many others in the different parts of the United States, are valuable and useful institutions.

RULE.—When the premium, at a certain rate per cent. for insuring a sum is required, the operation is the same as in Interest or Commission.

Examples.

1. What is the premium upon £220 14s. 6d. at 5 pr. cent.

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \quad \text{d.} \\
 5 \text{ per cent. is } \frac{1}{20}) 220 \quad 14 \quad 6 \\
 \hline
 11 \quad 0 \quad 8 \frac{1}{2} \frac{1}{2} \text{ Ans.}
 \end{array}$$

2. What is the premium upon £300 19s. 9d. at $7\frac{1}{2}$ per ct.
Ans. £22 11s. $5\frac{1}{2}$ d.

To find the sum for which a policy should be taken out to cover a given sum.

RULE.—Take the premium from £100, and say, as the remainder is to 100, so is the sum adventured to the policy.

Examples.

1. When it is required to cover £1518, premium 8 per ct. for what sum must the policy be taken?

$$\begin{array}{r}
 \text{£ } 100 \\
 \quad 8 \\
 \hline
 \text{As } 92 : 100 :: 1518 \\
 \qquad \qquad \qquad 100 \\
 \qquad \qquad \qquad \hline
 92 \overline{) 151800} (1650 \text{ } \textit{Answer.} \\
 \qquad \quad 92 \\
 \qquad \quad \hline
 \qquad \quad 598 \\
 \qquad \quad 552 \\
 \qquad \quad \hline
 \qquad \quad 460 \\
 \qquad \quad 460 \\
 \qquad \quad \hline
 \qquad \quad \dots 0
 \end{array}$$

2. A merchant sent a vessel and cargo to sea, valued at £3050, what sum must the policy be taken out for, to cover his property—premium 20 per cent. *Ans. £3812 10s.*

When a policy is taken out for a certain sum in order to cover a given sum to find the premium.

RULE.—As the policy is to the covered sum, so is £100 to a fourth number, which being taken from 100, will leave the premium.

Example.

If a policy be taken out for £2500 to cover £1000, what is the premium per cent.

$$\begin{array}{r}
 \text{As } \text{£}2500 : 1000 :: 100 \\
 \qquad \qquad \qquad 100 \\
 \qquad \qquad \qquad \hline
 25 \overline{) 10000} (40 \text{ and } \text{£}100 - 40 = \text{£}60 \text{ } \textit{Ans.} \\
 \qquad \quad 100 \\
 \qquad \quad \hline
 \qquad \quad 0
 \end{array}$$

When the policy for covering any sum and the premium per cent are given, to find the sum to be covered.

RULE.—Deduct the premium per cent. from 100, and say, as 100 is to the remainder, so is the policy to the sum required to be covered.

REBATE OR DISCOUNT.

Examples.

1. If a policy be taken out for £2500 at 60 per cent., what is the adventure or sum to be covered?

$$\begin{array}{r}
 \text{£.} \\
 100 \\
 60 \\
 \hline
 \text{As £100 : } 40 :: 2500 \\
 \hline
 40 \\
 100 \overline{) 1000} 00 \\
 \hline
 \text{£1000 Ans.}
 \end{array}$$

2. When a policy is taken out for £1230 at 40 per cent., what is the adventure or sum to be covered? *Ans. £.738.*

Rebate or Discount.

REBATE OR DISCOUNT, is an abatement made for the payment of money, bills, &c. before due, by accepting so much, as would amount to the whole debt at the time payable, at a given rate.

RULE 1.—As the amount of £100 for the given rate and time, is to £100, so is the sum given to the present worth, which subtracted from the given sum leaves the discount.—or,

2. As the amount of £100 for the given rate and time, is to the interest of £100 for that time, so is the given sum to the discount.

Examples.

1. What is the present worth and discount of £100 payable one year hence, at 6 per cent. per annum?

$$\begin{array}{r} 100 \\ 6 \\ \hline 6.00 \end{array}$$

100 Principal.
6 Interest.

$$\text{As } 106 : 100 :: 100$$

$$106 \overline{) 10000} (94 \text{ } 6 \text{ } 9\frac{1}{2}$$

$$\underline{954}$$

$$460$$

$$\underline{424}$$

$$36$$

$$\underline{26}$$

$$106 \overline{) 720} (6$$

$$\underline{636}$$

$$84$$

$$\underline{12}$$

$$106 \overline{) 1008} (9$$

$$\underline{954}$$

$$54$$

$$\underline{4}$$

$$106 \overline{) 216} (2$$

$$\underline{212}$$

$$4$$

Answer. {	£	s.	d.	
	100	0	0	given sum.
	94	6	9½	present worth.
	£5 13 2½			discount.

2. What is the discount and present worth of £450 10s for 6 months, at 6 per cent. per annum?

Ans. £13 2s 5d discount—£437 7s 7d present worth.

3. Bought goods amounting to £533 6s 8d payable 9 mo/ 10 days hence—what ready money will pay for them at a discount of 5 per cent. per annum ? *Ans. £513 7s 4½d.*

4. What is the present worth of £150, payable as follows, viz. $\frac{1}{3}$ at 3 months, $\frac{1}{3}$ at 8 months, and $\frac{1}{3}$ at 12 months, at 5 per cent. rebate per annum ? *£145 3s 8½d.*

NOTE.—As the interest is generally paid, instead of the discount, upon all bills said to be discounted, and as few people understand the difference between discount and interest, I shall in this place endeavour to explain the nature and reason of such difference :

1. If A borrow £100 for one year at 6 per cent. it is evident he must pay £6 interest for the use of the same at the years end : the interest therefore for £100 at 6 per cent. is £6.

2. If A. purchased goods to the value of £100 payable 1 year after the purchase, and the seller, B. offers to allow him 6 per cent. discount for prompt payment ; this deduction is made as a compensation for his loss of the interest on £100 for one year, and in such cases, £94 present money, is generally paid instead of £100 at the years end ; but this is unfair, because, the £94 at 6 per cent. will not make good the £100 in the time. The difference consists in this : Interest of borrowed money is not paid till the years end ; but in discounts, the interest is stopped before any use has been made of the money, or, in other words, interest is taken for the interest as well as for the principal. Bankers, &c. always deduct the interest, instead of the discount, and, as the interest is more than the discount, it is not probable that the error will be soon rectified.

Equation of Payments.

EQUATION OF PAYMENTS, is when several sums of money are due at different times, to find a mean time to pay the whole, to do which, we make use of the following rule, though not exactly true, yet near enough for all common uses.

RULE.—Multiply each payment by its time, and divide the total of the products by the sum payable at the time required, the quotient is generally accounted the equated time.

Examples.

1. A. owes B. £210, whereof £60 is to be paid at 5 months, £50 at 6 months, and £100 at 10 months; at what time may the whole debt be paid without prejudice to either?

$$\begin{array}{rcl}
 \text{£.} & \text{mo.} & \text{£.} \\
 60 & \times 5 & = 300 \\
 50 & \times 6 & = 300 \\
 100 & \times 10 & = 1000
 \end{array}$$

$$21 \overline{) 1600} \text{ (7 mo. 18 days } + \text{ Answer,}$$

147

13

30

$$21 \overline{) 390} \text{ (18}$$

21

180

168

12

2. I demand the equated time of three payments due as follows, viz. £133 $\frac{1}{3}$ at 3 months, £133 $\frac{1}{3}$ at 6 months, and £133 $\frac{1}{3}$ at 9 months? *Ans.* 6 months.

3. C. hath D's bonds due as follows, viz. £75 15/ 6d at 5 months, £87 at 8 months, and £95 17s 9d at 12 months, at what time shall the payments be made together?

Ans. 8 months, 18 days +

4. A merchant bought to the amount of £963 12s. 11 $\frac{1}{2}$ d. to pay £357 17s 6d at 93 days. £455 15s 5 $\frac{1}{2}$ at 119 days, and the balance at 365 days; but afterwards agreed to pay the whole at one payment—query; the time?

Ans. 4 months, 27 days +

Barter.

BARTER, is the exchanging of one commodity for another, and teaches traders to proportion their quantities, so that neither may suffer loss.

RULE.—Work by Compound Multiplication, the Rule of Three, or by Practice, as the tenor of the question may demand.

Examples.

1. How many yards of cloth at 10s per yard may I have in barter for 139 gallons of brandy, at 6s 8d per gallon?

$$\begin{array}{r}
 6d \text{ is } \frac{2}{3} \\
 \hline
 139 \\
 \underline{6} \\
 834 \\
 2 \text{ is } \frac{1}{3} \quad \begin{array}{r} 69 \ 6 \\ 23 \ 2 \\ \hline 926 \ 8 \\ 12 \end{array}
 \end{array}$$

10s. = 12|0)1112|0 value of Brandy in peace:

$$92 \frac{8}{11} = 92 \frac{2}{3} \text{ yards } \text{Ans.}$$

OR, THUS,

$$\begin{array}{r}
 139 \\
 \underline{80} \\
 10s. = 12|0)1112|0
 \end{array}$$

$$92 \frac{8}{11} = 92 \frac{2}{3} \text{ yards,}$$

Ans. as before.

2. What quantity of pepper at 4s per lb. can be had in barter for 4 cwt of tea, at 9s per lb. *Ans. 1008 lbs.*

3. How many pounds of cotton at 9d per lb. may be had in barter for 13cwt. 1qr. 14lb. of tobacco at 56s per cwt. *Ans. 998½ lb.*

4. A. and B. bartera. A. hath pimento at 27d. per pound; B. hath cinnamon worth 4s. per pound; query, how much cinnamon must B. give A. for 384 pounds of pimento? *Ans. 216 lbs.*

5. C. takes of D. 17 cwt. of cotton at 35s. 6d. per cwt. and gives him in return 19 pieces of linen at £.3 19s. 7½d. per piece, what is the balance and to whom due? *Ans. £45 9s. 4½d. due C.*

6. E. bartera with F. 176 pieces of cloth, each 47 ells of 6 quarters per ell, at 14s. 6d. per yard, for Humhums at 4s. 6d. per yard, how many yards of Humhums must F. give E. for his cloth? *Ans. 3998½ yards.*

7. G. and H. barter. G. hath nutmegs worth 5s. p. pound ready money; H. hath tea worth 4s. 6d. p. pound ready money, but in barter he would have 5s. 4½d. p. pound, what must G. rate his nutmegs at, to be equal in barter with H.

and how many pounds of his nutmegs will be equal in value to $75\frac{1}{2}$ lb. of H's. tea? *Ans.* G. should rate his nutmegs at 6s. per pound, and $67\frac{1}{2}$ lbs. of nutmegs will be equal to $75\frac{1}{2}$ lb. of tea.

8. K. hath linen worth $62\frac{1}{2}$ cents ready money, but in trade he will have 75 cents. L. hath cloth worth 3 dols. 50 cts. ready money; at what ought L. to rate his cloth p. yard, to make his profit equal to K's? *Ans.* 4 dols. 20 cts.

9. M. hath sugar worth 48s. 6d. per 100 lb. cash, but in barter 54s. 9d. pr. 100 lb. N. hath wine at 2s. 9d. pr. gall. cash, but in barter he will have 15 p. cent advance; query, how many gallons of N's. wine will be equal in value to 20 barrels of M's. sugar, each barrel containing 275 pounds?

Ans. 957 gallons +
10. O. has wheat worth 8s. 6d. per bushel ready money, but in barter he will have 10s. per bushel. P. has tobacco worth 18d. per pound ready money, how must he rate his tobacco per pound to equal the wheat in value?

Ans. 1s. 9d. +

Loss and Gain.

Loss and Gain, is an excellent rule, by which merchants and traders discover their profit or loss per cent.—It also instructs them to raise or fall in the price of their goods, so as to gain or lose so much per cent, &c.

RULE.—Work by the Rule of Three, or by Practice, as the nature of the question may demand.

Examples.

1. If I purchase cloth at 11*s.* 3*d.* per yard, and sell it again at 14*s.* 0 $\frac{1}{2}$ *d.* what per cent do I gain?

<i>s.</i> <i>d.</i> 14. 0 $\frac{1}{2}$ 11. 3 2. 9 $\frac{1}{2}$	<i>As</i> 11. 3 : : 2. 9 $\frac{1}{2}$: :	<i>s.</i> <i>d.</i> 11. 3 12 135 33 4 135 24000	: :	<i>£.</i> 100 20 2000 12 24000 540000 270 135) 3240000 (24000 270..... 540 540 ...000
---	--	--	-----	--

(4)
24000
12) 6000
500
10) 5000
2500
£25 Ans.

2. If a merchant buys 1000 Ells Flemish of linen for 300 dollars, at what must he sell it per yard to gain 30 dollars by the whole?

<i>E.</i> <i>dls.</i> As 1000 : 330 : : 1 100	<i>E.</i> <i>Ell.</i> As 1 : 33 : : 1 3	<i>cts.</i> <i>yd.</i> 33 : : 1 4
--	---	---

300 1000) 330000 30 330	}	33 cents. 3) 132 44 cents. <i>Ans.</i>
---	---	--

3. If one yard of muslin cost 11*s.* what is the gain p. cent, when the same is sold at 12*s.* 6*d.*? *Ans.* £13 12*s.* 8*d.* +

4. If 120 yards of cloth cost £36, what must one yard be sold for to gain 8 per cent? *Ans.* 6*s.* 5 $\frac{1}{2}$ *d.*

5. Bought cloth at 8*s.* 6*d.* per yard, what shall I sell it for to gain 23 $\frac{1}{2}$ per cent per yard? *Ans.* 10*s.* 5 $\frac{1}{2}$ *d.* +

6. Bought 550 yards India muslin for £200 and sell the same at 30*s.* per yard, what per cent do I gain? *Ans.* £312 10*s.*

7. Cloth bought at 15s. p. yard, and sold at 11s. 3d. what per cent is lost? *Ans. £33 6s. 8d.*

8. If wheat is bought at 10s. 16½d. per bushel, and sold at 7s. 6d. what per cent is lost? *Ans. £45.*

9. Purchased pepper at 1s. p. pound, and would sell it at 8½ per cent profit, what must I charge p. pound? *Ans. 13d.*

10. Bought goods to the value of £374 15s. but coming to a bad market, sold them 25 per cent under cost; how much did I receive for them? *Ans. £299 16s.*

11. Sold muslin at 10s. 6d. per yard, upon which I layed 23½ per cent; what did it cost? *Ans. 8s. 6d.*

12. Bought 7964 lb. of tobacco at 7½d. p. pound, and sold the same at 9½d. per pound, what was the gain per cent, and how much in the whole? *Ans. 30 per cent, and £74 13s. 3d. in the whole.*

Fellowship.

Fellowship teaches to value the profits and losses among merchants and others who trade together; by it we can make a division of a bankrupt's estate among his creditors, and adjust legacies among legatees, &c. &c. It is of two kinds, without and with time.

Fellowship without Time.

RULE.—As the whole sum or stock is to the whole gain or loss, so is each man's share in stock, to his quota of the gain or loss.

Proof.

Add the several shares together, and the sum will equal the given gain or loss.

Examples.

1. Two merchants trade together; A. put into stock £20, and B. £60, they gained £60, what is each man's share thereof?

FELLOWSHIP.

A. 10	As $\frac{\text{£}}{80}$	1	60	::	20	As $\frac{\text{£}}{80}$	60	::	60
B. 60			10				60		
<u>80</u>			<u>120</u>				<u>360</u>		
			810				360		
			<u>15</u>				<u>45</u>		
			Ans. $\frac{\text{£}}{15}$ for A.				Ans. $\frac{\text{£}}{45}$ for B.		

$$\begin{array}{r} \text{£} \\ 15 \\ \hline 45 \\ \hline \text{£ } 60 \text{ Proof.} \end{array}$$

2. Two merchants join in trade. C. put into stock 500*l*. and D. 700*l*. they gained 500*l*. what is each man's quota?

Ans. C. 208*l*. 6*s*. 8*d*. D. 291*l*. 13*s*. 4*d*.

3. Two men purchase goods to the value of 125*l*. B. paid 75*l*. and C. 50*l*. in the sale of which they gained 95*l*. what is each man's share thereof?

Ans. B. 57*l*. and C. 38*l*.

4. Four merchants. E. F. G. and H. entered into partnership. E. put into stock 750*l*. F. 800*l*. G. 700*l*. and H. 500*l*. They gained 568*l*. what is each man's share in proportion to his stock? Ans. E's. 150*l*. F's. 178*l*. G's. 140*l*. H's. 100*l*.

5. O. P. and Q. join in an adventure to Jamaica, which including charges, expences, &c. amounted to 20,000*l*. of which O. paid 4000*l*. P. 6000*l*. and Q. 10,000*l*. their returns cleared them 4333*l*. 6*s*. 8*d*. what is each person's quota?

Ans. { O's. quota, 866*l*. 13*s*. 4*d*.
P's. do. 1300*l*. 0*s*. 0*d*.
Q's. do. 2166*l*. 13*s*. 4*d*.

6. Four men join in an adventure to Madeira; K. put into stock 4000*l*. L. 210*l*. 10*s*. M. 490*l*. 14*s*. and N. 760*l*. which brought them returns (in wine) when disposed of; that cleared them 7680*l*. what is each man's share thereof?

Answer { K's. part 1650 10 11 +
L's. part 868 12 0 +
M's. part 2024 16 2 +
N's. part 3136 0 9 +

7. Three merchants trading to Philadelphia, lost goods to the value of 800 dollars. Now suppose A's. stock was 1200 dollars, B's. 4800 dollars. and C's. 2000 dollars; what sum must each man sustain of the loss? Ans. A. 120 dollars, B. 480 dollars, and C. 200 dollars.

8. Suppose the money and effects of a bankrupt amount to 1600*l.* 14*s.* 6*d.* and he is indebted to R. 742*l.* 12*s.* to S. 641*l.* 19*s.* and to T. 987*l.* 19*s.* 9*d.* how must it be divided among them?

Answer { R. must have 501*l.* 0*s.* 6½*d.* +
S. 433*l.* 2*s.* 4*d.* +
T. 666*l.* 11*s.* 7½*d.* +

Fellowship with Time.

RULE.—As the sum of the products of each man's money and time is to the whole gain or loss, so is each man's product to his share of the gain or loss.

Examples.

1. A. B. C. and D. joined in trade. A. put into stock 40*l.* for 2 months. B. 60*l.* for 4 months. C. 70*l.* for 7 months; and D. 80*l.* for 9 months. They sunk 20*s.* what did each man lose?

<i>l.</i>	<i>mo.</i>		
A 40	×	2 =	80
B 60	×	4 =	240
C 70	×	7 =	490
D 80	×	9 =	720
			1530

} As 1530 : 20 :: 80

80
 1530) 1600 (1
 1530
 70
 12
 1530) 840 (0
 4
 1530) 3360 (2
 3060
 300

As 1530 : 20 :: 240

$$\begin{array}{r}
 240 \\
 \hline
 800 \\
 40 \\
 \hline
 153 \overline{) 480} 0 \text{ (3)} \\
 \underline{459} \\
 21 \\
 12 \\
 \hline
 153 \overline{) 252} \text{ (1)} \\
 \underline{153} \\
 99 \\
 4 \\
 \hline
 153 \overline{) 396} \text{ (2)} \\
 \underline{306} \\
 900
 \end{array}$$

As 1530 : 20 :: 490

$$\begin{array}{r}
 490 \\
 \hline
 20 \\
 \hline
 153 \overline{) 980} 0 \text{ (6)} \\
 \underline{918} \\
 62 \\
 12 \\
 \hline
 153 \overline{) 744} \text{ (4)} \\
 \underline{612} \\
 132 \\
 4 \\
 \hline
 153 \overline{) 528} \text{ (3)} \\
 \underline{459} \\
 69.0
 \end{array}$$

As 1530 : 20 :: 720

$$\begin{array}{r}
 720 \\
 \hline
 20 \\
 \hline
 153 \overline{) 1440} 0 \text{ (9)} \\
 \underline{1377} \\
 63 \\
 12 \\
 \hline
 153 \overline{) 756} \text{ (4)} \\
 \underline{612} \\
 144 \\
 4 \\
 \hline
 153 \overline{) 576} \text{ (3)} \\
 \underline{459} \\
 117.0
 \end{array}$$

s.	d.		
1.	0 $\frac{1}{2}$	$\frac{360}{1530}$	A's
3.	1 $\frac{1}{2}$	$\frac{900}{1530}$	B's
6.	4 $\frac{1}{2}$	$\frac{690}{1530}$	C's
9.	4 $\frac{3}{4}$	$\frac{1170}{1530}$	D's

} Answer.

20 s. 0.—Proof.

2. Three men rent a pasture for £24. E. had forty cattle in it 4 months. F. 30 for 2 months; and G. 36 for 5 months; what part of the £24, must each man pay?

$$\begin{array}{rcl} \text{£.} & \text{s.} & \\ 9 & 12 & \text{E} \\ 3 & 12 & \text{F} \\ 10 & 16 & \text{G} \end{array} \left. \vphantom{\begin{array}{rcl} \text{£.} & \text{s.} & \\ 9 & 12 & \text{E} \\ 3 & 12 & \text{F} \\ 10 & 16 & \text{G} \end{array}} \right\} \text{Ans.}$$

3. K. L. and M. joined in the building a bridge for which they were to have £40. K. worked on it 60 days. L. 90; and M. 100 days; what must each man have agreeable to his work?

$$\begin{array}{rcl} \text{£.} & \text{s.} & \\ 9 & 12 & \text{K} \\ 14 & 8 & \text{L} \\ 16 & 0 & \text{M} \end{array} \left. \vphantom{\begin{array}{rcl} \text{£.} & \text{s.} & \\ 9 & 12 & \text{K} \\ 14 & 8 & \text{L} \\ 16 & 0 & \text{M} \end{array}} \right\} \text{Ans.}$$

4. E. F. and G. join in trade for 12 months. E. put into stock £60 at first, and 4 months afterwards £70 more. F. £40 at first, and two months after £90 more. G. £90 at first, and 4 months after £75 more. They gained £1000; what was each man's share?

$$\begin{array}{rcl} \text{£.} & \text{s.} & \text{d.} \\ 294 & 18 & 7 \frac{178}{434} \text{ E's.} \\ 317 & 19 & 5 \frac{158}{434} \text{ F's.} \\ 387 & 1 & 11 \frac{98}{434} \text{ G's.} \end{array} \left. \vphantom{\begin{array}{rcl} \text{£.} & \text{s.} & \text{d.} \\ 294 & 18 & 7 \frac{178}{434} \text{ E's.} \\ 317 & 19 & 5 \frac{158}{434} \text{ F's.} \\ 387 & 1 & 11 \frac{98}{434} \text{ G's.} \end{array}} \right\} \text{Ans.}$$

5. Three merchants joined in trade. O. put into stock £750 for 15 months. P. £666 for 17 months; and Q. £807 for 19 months; they gained £725—what is each person's part?

$$\begin{array}{rcl} \text{£.} & \text{s.} & \text{d.} \\ 215 & 3 & 6 \frac{1}{4} \frac{2055}{37905} \text{ O's.} \\ 216 & 11 & 0 \frac{3}{4} \frac{3045}{37905} \text{ P's.} \\ 293 & 5 & 4 \frac{3}{4} \frac{32205}{37905} \text{ Q's.} \end{array} \left. \vphantom{\begin{array}{rcl} \text{£.} & \text{s.} & \text{d.} \\ 215 & 3 & 6 \frac{1}{4} \frac{2055}{37905} \text{ O's.} \\ 216 & 11 & 0 \frac{3}{4} \frac{3045}{37905} \text{ P's.} \\ 293 & 5 & 4 \frac{3}{4} \frac{32205}{37905} \text{ Q's.} \end{array}} \right\} \text{Ans.}$$

Exchange.

Exchange, implies the receiving or paying of money in one country for a similar sum in another, by means of bills of exchange.

The course of Exchange, is the current price between two places, which is always fluctuating and unsettled, being sometimes above, and at others, below par, according to the circumstances of trade and commerce.

The exchange of American currencies, United States money, &c. into each other, and into English, Irish, French and Dutch monies, having been so generally treated under the head of Reduction, it seems almost unnecessary to repeat it here (See pages from 50 to 61). But for the benefit and furtherance of pupils, &c. I will here subjoin another Rule, together with a table exhibiting the oremes, by which this kind of exchange, may be performed by other methods.

RULE.—As the dollar of the known currency is to the dollar of the currency which you wish to find, so is the given sum to the answer of the question;

Or,—work by the theorem in the following table, opposite to the state of which the given sum is, and under that to which it is to be reduced.

PROOF.—Vary the operation, or prove one of these methods by the other.

EXCHANGE.

A TABLE,
Exhibiting the value of a Dollar in the currency of the respective United States : and Theorums for exchanging the currency of any State, to that of another, and to Federal money.

TO EXCHANGE THE CURRENCY OF		N. E. States, Virginia, Kentucky, and Tennessee		Pennsylvania, New Jersey, Delaware, & Maryland.		New York & N. Carolina.		S. Carolina and Georgia.		Federal Money of the United States.	
*The New Eng. States, Virginia, Kentucky and Tennessee.		Dollar, 6s.	Add one fourth.	Add one third.	Subtract two ninths	£. $\times 10 \div 3$ = Dol. or pence $\times 25 \div 18$ = cts.					
Pennsylvania, New Jersey, Delaware and Maryland.	Subtract one 5th.	Dollar 7s. 6d.	Add one 15th.	$\times 3\frac{1}{2}$ and $\div$ by 5.	£. $\times 8 \div 3$ = Dol. or pence $\div \frac{1}{3}$ = cents.						
New York and North Carolina.	Subtract one 4th.	Subtract one 16th.	Dollar 8s.	To $\frac{1}{2}$ add one 6th of the $\frac{1}{2}$.	£. $\times 5 \div 2$ = Dol. or pence $\div$ one 24th = c.						
South Carolina, and Georgia.	Add two 7ths.	Add $\frac{1}{2}$ that $\frac{1}{2}$ and $\frac{1}{2}$ that $\frac{1}{2}$.	$\times 2$ and sub. $\frac{1}{2}$ of product.	Dollar 4s. 8d.	£. $\times 30 \div 7$ = Dol. or pence $\times 25 \div 14$ = cts.						
Federal money of the United States.	$\times 18 \div 25$ = pence or d. $\times$ $3 \div 10$ = £.	$\div 3$ = d. or $\times 3 \div 8$ = c.	$\div 25$ = pence or d. $\times 2 \div 5$ = £.	$\times 14 \div 25$ = pence or d. $\times 7 \div 30$ = £.	Dollar 100 cents.						

*The New England States, are New Hampshire, Massachusetts, Rhode Island, Connecticut and Vermont.

EXCHANGE.

Examples.

1. What is the value of £840 South-Carolina in New-York.

s. d. s. s.
As 4 . 8 .. 8 :: 840 .. £1440 *Ans.*

Or, $\begin{array}{r} \text{£.} \\ 840 \\ 2 \end{array}$

$\begin{array}{r} 1680 \\ 240 \\ \hline \end{array}$

£1440 *Answer as before.*

2. What is the value of a bill of £375 Maryland, or other like currency, in New York or North-Carolina currency?

Ans. £400.

3. If £347 12s. be transmitted from New-York to Ohio; what sum is it equal to in the latter state?

Ans. £325 17s. 6d.

4. *Richmond, Virginia, July 26th, 1808.*

Thirty days after sight pay to William Penn, or order, six hundred pounds Virginia currency, as per advise, from your friend

JOHN LACKLAND.

To Mr. James Nourse, Merchant, Washington.

How much Maryland currency will discharge the above bill?

Ans. £750.

5. A merchant in Edenton, North-Carolina, owes to a Virginia planter £480; how much should he be charged with in the planter's books?

Ans. £360.

6. How much Georgia currency is equal to £3000 Pennsylvania currency?

Ans. £1866 13s. 4d.

7. A. of Lexington, Kentucky, draws on B. of Delaware, for £209 13s. 6d.; what sum in the last mentioned currency will pay this draft?

Ans. £262 1s. 10½d.

8. *Wilmington, N. Carolina, July 4th, 1808.*

Ten days after sight please to pay to William Jones, or order, eleven hundred twenty-five pounds seven shillings and four pence, value received; and place the same to account, as per advice from your friend,

B. B. WOODSON.

To William Evans, Merchant, Augusta.

What sum, Georgia currency, will discharge this bill?

Ans. £656 *qs.* 3*d.*

9. How much, Tennessee currency, will purchase a bill for £560, South-Carolina currency?

Ans. £720.

Foreign Exchanges.

Accounts are kept in England, Ireland, and the West-India Islands, in pounds, shillings, pence and farthings: (see table page 62) though their intrinsic values in these places are different.

A Table of different monies.

FRANCE.

12 Deniers	= 1 Sol,
20 Sols	= 1 Livre,
3 Livres	= 1 Crown.

SPAIN.

4 Marvadies vellon, or	} = 1 Quarta,
2½ Marvadies of plate,	
8½ Quartas, or	} = 1 Rial Vellon,
34 Marvadies vellon	
16 Quartas, or	} = 1 Rial of Plate,
34 Marvadies.	
8 Rials of Plate	= 1 Piastre, Pezo or dollar,
5 Piafres	= 1 Spanish pistole;
2 Spanish Pistoles	= 1 Doubleloon.

ITALY.

12 Deniers	= 1 Sol,
20 Sols	= 1 Livre,
5 Livres	= 1 Piece of Eight at Genoa,
6 Livres	= 1 do. at Leghorn,
6 Solhdi	= 1 Grois,
24 Groffes	= 1 Ducat.

PORTUGAL.

400 Reas	= 1 Crusadoc,
1000 Reas	= 1 Millrea.

HOLLAND.

8 Pennings	= 1 Groat,
2 Groats	= 1 Stiver = 2 <i>d.</i>
6 Stivers	= 1 Schelling,
20 Stivers	= 1 Florin or Rix-Guilder,
2½ Florins	= 1 Rix dollar,
6 Florins	= 1 £ Flemish,
5 Guilders	= 1 Ducat.

DENMARK.

16 Shillings	= 1 Mark,
6 Marks	= 1 Rix Dollar,
33 Rulkics	= 1 Copper Dollar,
6 Copper dollars	= 1 Rix Dollar.

RUSSIA.

18 Pennius	= 1 Gros,
30 Gros	= 1 Florin,
3 Florins	= 1 Rix Dollar,
2 Rix Dollars	= 1 Gold Ducat.

RULE.—The different operations, in the exchanging of monies, are performed by the Single Rule of Three, or by Practice.

Examples.

1. A. of Virginia is indebted to B. of London £1360 15s. currency; what sterling sum must be remitted, when the exchange is at $37\frac{1}{2}$ per cent?

As £. s. :: £. s. :: £989 12s. 8½d. + Ans.

Or, £. s. o
1360 15 0
3

£. 37½ is ⅔ 11) 4082 5 0

371 2 3½

£. 989 12 8½ Ans. with the difference of one farthing.

2. B. of London receives a bill of exchange from A. of Virginia for £650 12s. 6d. sterling; for how much currency was it drawn—exchange being at $37\frac{1}{2}$ per cent?

£.	£.	s.	d.
20 10 5 2½	670	12	6
	134	2	6
	67	1	3
	33	10	7½
	16	15	3½
£. 922	2	2½	Ans.

Or, 670 12 6
3
1) 2011 17 6
251 9 8½
670 12 6
£. 922 2 2½

3. C. of Jamaica is indebted to D. of London £735 6s. 4d. sterling; with how much currency will C. be credited for at Jamaica, when the exchange is at $36\frac{1}{2}$ per cent.

Ans. £1003 14s. 1½d. +

4. E. of Dublin draws upon F. of London for £1481 9s. Irish exchange, at 12 per cent; how much sterling will discharge said bill?

Ans. £1322 14s. 5½d.

5. How much sterling will be equal to £905 10s. 6d. Pennsylvania currency, the exchange at 75 per cent?

Ans. £679 2s. 10½d.

6. What sum sterling will be equal to £420 17s. Virginia currency, exchange at 44 per cent?

Ans. £361 14s.

7. *Richmond, Sept. 22, 1808.*

Exchange for 4226 Livres, 12 Sols, 8 Deniers.

Sixty days after sight of this my second of exchange, first of the same tenor and date not paid, pay to James Walker, or order, four thousand two hundred and twenty-six livres, twelve sols, and eight deniers, value received, and place the same to account as per advice from yours,

JOHN MORRIS.

To Thomas Gordon, Merchant, London.

How much sterling is the above bill at $10\frac{1}{2}$ d. per livre, and what sum in Virginia currency at 15d. per livre?

Ans. { £184 18s. 3½d. Sterling.
£264 3s. 3½d. Currency.

8. A Virginia merchant imported goods from France, amounting per invoice to 24504 livres, how much currency of that state at 15d. per livre, will they amount to, and how much sterling will discharge the debt, exchange at par?

Ans. { £1531 10s. 0d. Currency.
£1148 12s. 6d. Sterling.

9. G. of Baltimore, receives of B. of Amsterdam, an invoice of goods amounting to 10235 florins, 17 stivers, 8 pen-nings; how much Maryland currency must be remitted to discharge the bill at $35\frac{1}{4}$ d. per florin; and what is the sum in sterling, exchange at 38s. 6d. Flemish per pound sterling?

Ans. { £1503 7s. 10½d. Currency.
£886 4s. 5½d. Sterling.

10. A bill for 2524 pezo's, 7 ria. 33 mar. being remitted to Seville; what sum Virginia currency is equal thereto, at 6s. per pezo?

Ans. £780 9s. 0½d. -†

11. How much sterling money may a merchant receive in London, if he pays in Genoa 976 dollars, at 53*d.* each?

Ans. £215 10*s.* 8*d.*

12. A gentleman travelling would exchange £60 14*s.* 7*d.* sterling for Venice ducats at 4*s.* 5*d.* each; how many must he receive?

Ans. 275.

13. If a merchant pays a bill at London of £1193 17*s.* 6½*d.* what must he draw for on his correspondent at Lisbon, exchange at 5*s.* 5½*d.* per milreas?

Ans. 4366 milreas, 183 reas.

14. If a bill be drawn from London of £441. 2*s.* 11*d.* sterling; how many milreas, 6*s.* 5*d.* each, is equal thereto?

Ans. 1375.

15. A merchant in Holland determines to turn 4376 florins currency into banco, the agio at 4 per cent; how many pounds Flemish banco must he receive?

Ans. £701 1 florin. 13 *sti.* 13 *pen.*

NOTE.—The bank money is worth more than the current: the difference between the one and the other is called agio, and is generally from 3 to 6 per cent, in favour of the bank.

Alligation.

ALLIGATION is a rule by which we are taught to adjust the prices and simples of compound quantities.

When several simple quantities, and their prices are given, and a mean price of any part of the compound is required.

RULE.—As the whole composition is to its total value, so is any part of the composition to its mean price.

Examples.

1. A farmer mixed 20 bushels of wheat at 5*s.* per bushel, and 30 of Rye at 4*s.* per bushel, with 40 of barley at 3*s.* per bushel; I desire to know the worth of a bushel of this mixture?

$$20 \times 5 = 100$$

$$30 \times 4 = 120$$

$$40 \times 3 = 120$$

$$\hline 90$$

$$\hline 340 = 3*s.* 9½*d.* + *Ans.*$$

2. If 36 bushels of wheat at 3*s*. 9*d*. per bushel, 52 bushels of barley at 4*s*. per bushel, 64 bushels of rye at 3*s*. per bushel, and 27 bushels of oats at 2*s*. per bushel, be mixed together; what is a bushel of this mixture worth?

Ans. 3*s*. 3½*d*. $\frac{169}{179}$

3. A refiner melted 12 lb. of silver bullion, of 6 oz's. fine, with 8 lb. of 7 oz's. fine, of what fineness is 1 lb. of this mass?

Ans. 6 oz. 18 dwt. 16 gra.

4. A grocer mixes 40 gallons of rum at 5*s*. 6*d*. per gallon with 80 gallons at 4*s*. 6*d*. with 75 at 3*s*. 6*d*. and 50 at 2*s*. 6*d*. what is one gallon of said mixture worth?

Ans. 3*s*. 11½*d*. $\frac{135}{141}$

When the prices of several simples and the mean rate are given, without any quantity, to find how much of each simple is required to compose the mixture.

RULE.—Place the rates of the simples under each other, link each rate, which is less than the mean, with one that is greater, the difference or sum of the differences, between each rate and the mean price, placed opposite the respective rate or rates, with which it is linked, will be the several quantities required.

NOTE.—Different modes of linking, will produce different answers.

Examples.

1. How much tea at 19*s*. 14*s*. 9*s*. and 8*s*. will it take to make a mixture worth 10*s*. per pound?

Answer.

19—	1 of 19 =	19
14—	2 of 14 =	28
10. 9—	9 of 9 =	81
8—	4 of 8 =	32
	16	160
	10 Proof.	

2. A grocer would mix four sorts of coffee together, of 18*d*. 20*d*. 24*d*. and 28*d*. per pound; what quantity of each must he take to make a mixture worth 22*d*. per pound?

	18	2 of 18d.	} <i>Answer.</i>
	20	6 of 20d.	
22	24	4 of 24d.	
	28	2 of 28d.	

3. A farmer would mix as much rye at 4s. per bushel, barley at 3s. 6d. per bushel, and oats at 2s. per bushel, as to make a mixture worth 2s. 6d. required the quantity of each?

Ans. 6 of rye, 6 of barley, 30 of oats.

When the prices of all the simples, the quantity of but one of them, and the mean rate, are given to find the several quantities of the rest, in proportion to that given.

RULE.—Take the difference between each price, and the mean rate, as before (in the preceding rule). Then,

As the difference of that simple whose quantity is given is to the rest of the differences severally, so is the quantity given to the several quantities required.

Examples.

1. A merchant being determined to mix 20 lbs. of pepper at 15d. per lb. with others at 16d. per pound, at 18d. per pound, and 22d. per pound; how many pounds of each sort must he take to make one pound of such mixture worth 17d.

Answers.

Proof.

	15	5	20lb. at 15d. =	300d.	As 5 .. 1 :: 20 .. 4
	16	1	4lb. at 16d. =	64d.	As 5 .. 1 :: 20 .. 4
17	18	1	4lb. at 18d. =	72d.	As 5 .. 2 :: 20 .. 8
	22	2	8lb. at 22d. =	176d.	
		36			612 :: 1 lb. .. 17d.

2. A farmer would mix 20 bushels of wheat at 5s. per bushel with rye at 3s. barley at 2s. and oats at 1s. 6d. per bushel? how much should he take of each sort, to make the composition worth 2s. 8d. per bushel?

Ans. 20 bushels of wheat, 35 of rye, 70 of barley, and 10 bushels of oats.

3. How much gold of 16, 20 and 24 carats fine ; and how much alloy, must be mixed with 10 ozs. of 18 carats fine, that the composition may be 22 carats fine ?

Ans. 10 ozs. of 16 carats fine, 10 of 20, 170 of 24, and 10 of alloy.

When the prices of the several simples, the quantity to be compounded, and the mean rate thereof are given, to find the quantity of each simple.

RULE.—Take the difference between each price and the mean rate as before ; then,

As the sum of the difference is to each particular difference, so is the quantity given to the quantity required.

Examples.

1. A grocer hath four sorts currants, viz. 12*d.* 10*d.* 6*d.* and 4*d.* per pound, and would make a composition of 144 lbs. worth 8*d.* per pound ; I desire to know what quantity of each he must take ?

8.	12—	4—	48 at 12 <i>d.</i> =	576	As 12 .. 4 :: 144 .. 48
	10—	2—	24 at 10 <i>d.</i> =	240	As 12 .. 2 :: 144 .. 48
	6—	2—	24 at 6 <i>d.</i> =	144	
	4—	4—	48 at 4 <i>d.</i> =	192	
	12	144		1152	(8 <i>d.</i>

2. A person has four kinds of sugar, viz. 11*d.* 9*d.* 6*d.* and 4*d.* and being desirous of making a composition of 240 lbs. worth 8*d.* per pound ; what quantity of each sort must he take ?

Ans. 48*lb.* at 11*d.* 96*lb.* at 9*d.* 72*lb.* at 6*d.* and 24*lb.* at 4*d.*

3. A silversmith hath four different kinds of gold, viz. of 24 carats fine, of 22, 20, and 15 carats fine ; how much of each sort must he take, so as to have 42 ozs. 17 carats fine ?

Ans. 4 of 24 ; 4 of 22 ; 4 of 20, and 30 of 15 carats fine.

Position.

POSITION is a rule, which, by false or supposed numbers, taken at pleasure, discovers the true ones required. It is divided into Single and Double.

Single Position.

SINGLE POSITION teaches to answer those questions, the results of which are proportional to their suppositions: Such are those which require the multiplication or division of the number sought by any proposed number; or, when it is to be increased or diminished by itself, a certain proposed number of times.

RULE.—Work with a supposed number, as the tenor of the question may require; then,

As the total of the errors is to the true total, so is the supposed number to the true one required.

PROOF.—Add the several parts of them together, when it agrees with the sum it is right.

Examples.

1. A schoolmaster being asked how many scholars he had, replied, if I had as many, half as many and one quarter as many more, I should have 44; how many had he?

Suppose he had	20	As	55	..	44	::	20
As many	20				20		
Half as many	10				—		
$\frac{1}{4}$ as many	5		55	)	880	(16	Ans.
	<u>7</u>				55		
	55				—		
	<u>—</u>				330		
			16		330		
			16		—		
			8		...		
			4		—		
			<u>—</u>				
			44		Proof.		
			<u>—</u>				

2. A person having about him a certain number of half eagles, said, if the third, fourth and sixth of them were added together, they would make 54; I desire to know how many he had? Ans. 72.

3. A gentleman purchased a chaise, horse and harness for £120. The horse came to twice the price of the harness, and the chaise to twice the price of the horse and harness; what did he give for each?

Ans. Horse £26 13s. 4d. Harness £13 6s. 8d. Chaise £80.

4. Two men having found a bag of money, disputed who should have it. A. said that the half, third and fourth of the money made 130 dollars; and if B. could tell him how much was in the bag, he should have the whole, otherwise he should have none: pray how many dollars did the bag contain?

Ans. 120 dollars.

5. What is the age of a man who says, that if $\frac{3}{7}$ of the years I have lived, be multiplied by 7, and $\frac{2}{7}$ of them be added to the product, the sum will be 292 years?

Ans. 60 years.

6. What sum at 6 per cent per annum, will amount to £860 in 12 years?

Ans. £500.

7. The yearly interest of Eliza's money at 6 per cent per annum exceeds $\frac{1}{10}$ of the principal by an £100; and she does not intend to marry any man, who is not scholar enough to tell her fortune; pray what is it?

Ans. £10,000.

Double Position.

DOUBLE POSITION teaches to answer questions, by making two suppositions of false numbers.

RULE. 1.—Take any two convenient numbers, and proceed with each according to the tenor of the question, noting the errors of the results; multiply the errors of each operation into the supposed number of the other cross wise; then,

If the errors be alike, that is, both greater, or both less than the given number, take their difference for a divisor, and the difference of their products for a dividend: But if unlike, take their sum for a divisor and the sum of their products for a dividend, the quotient will be the answer.

Proof as in Single Position.

Examples.

1. Three men would divide 200 dollars among themselves. so that B. may have 6 dollars more than A. and C. 8 dollars more than B. How many must each man have?

Suppose A. had 40	Then suppose A. had 50
Then B. — 46	Then B. must have 56
And C. — 54	And C. 64
140	170
Too little by 60.	To little by 30.

<i>Suppose</i>	<i>Errors.</i>	
40	60	60 A.
50 X	30	66 B. } <i>Ans.</i>
3000	1200	74 C. }
1200	30 divisor.	200 Proof.
30)1800		
60		
Answer for A.		

2. An inquisitive beau asked a young lady how many yards of cloth she had in her loom; she humourously answered, it is half black, one third blue, and 9 yards white; pray, sir, be good enough to tell me the number? *Ans.* 54 yards.

3. An old bachelor paying his addressee to a young lady, inadvertently asked her her age; she replied, if it was doubled, and $\frac{3}{4}$ of that product added to it; and that sum multiplied by 5, it would be 200 years; and altho', continues she, your age may be nearly half that number (200), yet, if you can tell mine, I'll not hesitate in giving my hand to you in marriage; pray what was the young lady's age? *Ans.* 16 years.

4. X. Y. and Z. three noted gamblers, playing at cards; the money staked was 196 guineas, but disagreeing, each seized as many as he could; X. got a certain quantity; Y. as many as X. and 16 more; and Z. $\frac{1}{2}$ of both their sums; how many did each get? *Ans.* X. 76; Y. 92; and Z. 28.

5. Three merchants built a ship which cost them £7500. A. paid a certain sum unknown; B. paid as much as A. and £50 more; and C. paid as much as them both; what did each pay? *Ans.* A. £1850. B. £1900. and C. £3750.

6. Three persons discoursed thus concerning their ages; says E. I am 30 years old; says F. I am as old as E. and $\frac{1}{4}$ of G; and says G. I am as old as you both; what was the age of each person? *Ans.* 30 years. F. 50. and G. 80 years.

7. The head of a fish is 9 inches long, and its tail is as long as its head and half the body, and the length of the body equal those of the head and tail; what is the whole length? *Ans.* 6 feet.

Involution; or the raising of Powers.

A POWER is the product arising from multiplying any given number into itself continually, a certain number of times; thus,

$3 \times 3 = 9$ is the second power, or square of 3.
 $3 \times 3 \times 3 = 27$ is the third power, or Cube of 3.
 $3 \times 3 \times 3 \times 3 = 81$ is the fourth power of 3.

The number denoting the power is called the Index, or the exponent of that power.

When two or more powers are multiplied together, their product is that power whose index is the sum of the exponents of the factors; thus,

$2 \times 2 = 4$ the square of 2;

$4 \times 4 = 16$ — 4th power of 2;

And $16 \times 16 = 256$ — 8th power of 2, &c.

TABLE OF THE FIRST NINE POWERS.

Roots.	Squares.	Cubes.	4th power.	5th power.	6th power.	7th power.	8th power.	9th power.
1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512
3	9	27	81	243	729	2187	6561	19683
4	16	64	256	1024	4096	16384	65536	262144
5	25	125	625	3125	15625	78125	390625	1953125
6	36	216	1296	7776	46656	279936	1679616	10077696
7	49	343	2401	16807	117649	823543	5764801	40353607
8	64	512	4096	32768	262144	2097152	16777216	134217728
9	81	729	6561	59049	531441	4782969	43046721	387420489

Examples.

1. What is the seventh power of 6?

$$6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6 = 279936 = 7^{th} \text{ power.}$$

2. What is the third power or cube of 25?
- Ans.*
- 15625

3. What is the fourth power of
- $\frac{1}{2}$
- ?
- Ans.*
- $\frac{1}{16}$

4. What is the fourth power of .045?
- Ans.*
- .00004100625

5. What is the seventh of 5.03?
- Ans.*
- 16196.003304479729

6. What is the eighth power of
- $3\frac{1}{2}$
- ?
- Ans.*
- 17857
- $\frac{366816}{196825}$

Evolution; or the extracting of Roots.

The root of any number, or power, is such a number, as, being multiplied into itself a certain number of times, will produce that power: Thus, 2 is the square root of 4, because $2 \times 2 = 4$; and 4 is the cube root of 64, because $4 \times 4 \times 4 = 64$, &c. &c.

*Square Root.**Extraction of the Square Root.*

The square of a number is the product arising from that number multiplied into itself.

The extraction of the square root is the finding of such a number, as, being multiplied by itself, will produce that proposed.

RULE 1.—Point the given number, beginning at the units place, then to the hundreds, and so upon every second figure throughout.

2. Seek the greatest square number in the first point towards the left hand, placing the square number under the first point, and the root thereof in the quotient, subtract the square number from the first point, and to the remainder bring down the next point, and call that the resolvend.

3. Double the quotient, and place it for a divisor on the left hand of the resolvend; seek how often the divisor is contain-

ed in the resolvend (preserving always the units place), and put the answer in the quotient, and also on the right hand side of the divisor; then multiply by the last figure put in the quotient, and subtract the product from the resolvend; bring down the next point to the remainder (if there be any more), and proceed as before.

PROOF.—Square the root, adding in the remainder (if any), which will equal the number given.

NOTE.—When the given number consists of a whole number, and decimals together, make the number of decimals even, by adding cyphers to them, so that there may a point fall on the units place of the whole number.

Examples.

1. What is the square root of 119025?

Ans. 345

$ \begin{array}{r} 119025 \text{ } 345 \text{ the root.} \\ \underline{9} \\ 64 \overline{)290} \\ \underline{256} \\ 685 \overline{)3425} \\ \underline{3425} \\ 0 \end{array} $	$ \begin{array}{r} 345 \\ \underline{345} \\ 1725 \\ \underline{1380} \\ 1035 \\ \underline{119025} \text{ Proof.} \end{array} $
---	---

2. What is the square root of 30138696025?

Ans. 173605

3. What is the square root of 10342656?

Ans. 3216

4. What is the square root of 14876.2357?

Ans. 121.968175

5. What is the square root of 106929?

Ans. 327

6. What is the square root of 7596796?

Ans. 1506.23 +

7. What is the square root of 36372961?

Ans. 6031

8. What is the square root of 22071204?

Ans. 4698

9. What is the square root of 2.2710957?

Ans. 1.50701 +

10. What is the square root of 234.09?

Ans. 15.3

11. What is the square root of 10?

Ans. 3.162277 +

12. What is the square root of .045369?

Ans. .213

SQUARE ROOT.

To extract the Square Root of a Vulgar Fraction.

RULE.—Reduce the fraction to its lowest terms; then extract the square root of the numerator for a new numerator; and the square root of the denominator for a new denominator.

NOTE.—If the fraction be a surd, that is, a number where a root cannot be exactly found, reduce it to a decimal and extract the root of it.

Examples.

- | | |
|---|---------------------------|
| 1. What is the square root of $\frac{2544}{6736}$? | <i>Ans.</i> $\frac{2}{3}$ |
| 2. What is the square root of $\frac{2704}{2331}$? | <i>Ans.</i> $\frac{2}{3}$ |
| 3. What is the square root of $\frac{7056}{8100}$? | <i>Ans.</i> $\frac{2}{3}$ |

Surds.

- | | |
|---|------------------------|
| 4. What is the square root of $\frac{275}{340}$? | <i>Ans.</i> $.89934 +$ |
| 5. What is the square root of $\frac{587}{777}$? | $— .72414 +$ |
| 6. What is the square root of $\frac{3168}{8192}$? | $— .71528 +$ |

To extract the Square Root of a mixed number.

RULE 1.—Reduce the fractional part of the mixed number to its lowest term, and then the mixed number to an improper fraction.

2. Extract the roots of the numerator and denominator, for a new numerator, and denominator.

NOTE.—If the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the square root from the whole.

Examples.

- | | |
|---|----------------------------|
| 1. What is the square root of $39\frac{3}{4}$? | <i>Ans.</i> $6\frac{1}{2}$ |
| 2. What is the square root of $17\frac{1}{2}$? | $— 4\frac{1}{2}$ |
| 3. What is the square root of $5\frac{3}{4}$? | $— 2\frac{1}{2}$ |

Surds.

- | | |
|---|------------------------|
| 4. What is the square root of $76\frac{1}{4}$? | <i>Ans.</i> $8.7949 +$ |
| 5. What is the square root of $7\frac{1}{4}$? | $— 2.7961 +$ |
| 6. What is the square root of $6\frac{1}{4}$? | $— 2.5819 +$ |

Practical Questions, and use of the Square Root.

1. There is an army consisting of a certain number of soldiers, who are placed rank and file, (that is in the form of a square, each side having 472 men); I desire to know how many the whole square contains? *Ans.* 222784 men.

2. A certain pavement is made exactly square, each side of which contains 75 feet; I demand how many square feet are contained therein? *Ans.* 5625.

3. Suppose 12544 soldiers are to be put into rank and file, in the form of an equal square; how many must stand in front, and how many deep? *Ans.* 112 soldiers.

To find a mean proportional between two numbers.

RULE.—Multiply the given numbers together, and extract the square root of the product; which root will be the mean proportional sought.

Examples.

1. What is the mean proportional between 3 and 12?

$$\begin{array}{r} 12 \\ 3 \\ \hline 36 \\ 30 \\ \hline 6 \end{array}$$

Answer.

2. What is the mean proportional between 24 and 96?

Ans. 48.

To find the side of a square equal in area to any given superficies.

RULE.—Find the area, and the square root is the side of square sought.

Examples.

1. If the area of a triangle be 160; what is the side of a square equal in area thereto? *Ans.* 12.649+

2. If the area of a circle be 750; what is the side of the square equal to? *Ans.* 27.38612

The area of a circle given to find the diameter.

RULE.—Multiply the given area, by 1.2732, and the product will be the square of the diameter; then, extracting the square root of the product, you will have the diameter.

Examples.

1. The area of a circle being 113.09; what is the diameter?
Ans. 11.999 $\div$ = 12 diameter.

2. What length of cord must be tied to a cow's tail, the other end fixed in the ground, to let her have liberty of eating an acre of grass, and no more, supposing the cow and tail to be $5\frac{1}{2}$ yards?
Ans. 6.136 perches.

The area of a circle given to find the periphery or circumference.

RULE.—Multiply the given area by 12.566, and extract the square root of the product, which root will be the circumference required.

Examples.

1. The area of a circle being 113.03; what is the circumference?
Ans. 37.68 $\div$

2. If the area of a circle be 12; what is the periphery?
Ans. 12.2798

3. When the area is 160; what is the circumference?
Ans. 44.839

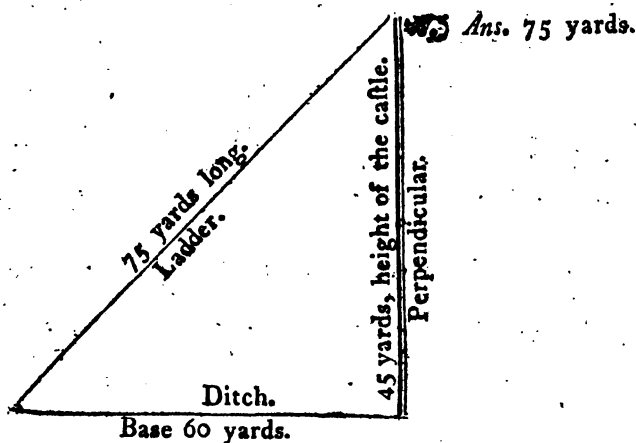
Any two sides of a right-angled triangle given to find the third side.

1. The base and perpendicular given to find the hypotenuse.

RULE.—The square root of the sum of the squares of the base and perpendicular is the length of the hypotenuse.

Examples.

1. The top of a castle from the ground is 45 yards high and surrounded with a ditch 60 yards broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle?



Suppose a ladder 60 feet long, be so planted as to reach a window 37 feet from the ground on one side of the street; and without moving it at foot, will reach a window 23 feet on the other side; what breadth was the street of?

Ans. 102.64 feet.

Promiscuous Questions.

A certain number of men gave 30s. 1d. for a charitable institution; each man giving as many pence as there were men; I demand their number? *Ans.* 19 men.

If a circular pipe of 1.5 inches diameter fill a cistern in five hours; in what time would it be filled by one of 3.5 inches diameter? *Ans.* 55 minutes, 6 seconds.

Cube Root.

Extraction of the Cube Root.

The Cube of a number is the product of that number multiplied into its Square.

Extraction of the Cube Root is the finding of such a number, as, being multiplied into its Square, will produce the number proposed.

CUBE ROOT.

1. Point every third figure of the cube given, beginning at the units place; seek the greatest cube to the first point, and subtract it therefrom; put the root in the quotient, and bring down the figures in the next point to the remainder for a resolvend.

2. Find a divisor, by multiplying the square of the quotient by 3. See how often it is contained in the resolvend, rejecting the units and tens, and put the answer in the quotient.

3. To find the subtrahend—1st. Cube the last figure in the quotient—2d. Multiply all the figures in the quotient by 3, except the last, and that product by the square of the last—3d. Multiply the divisor by the last figure. Add these products together, gives the subtrahend, which subtract from the resolvend; to the remainder bring down the next point, and proceed as before.

Roots—1. 2. 3. 4. 5. 6. 7. 8. 9.

Cubes—1. 8. 27. 64. 125. 216. 343. 512. 729.

Examples.

1. What is the cube root of 99252847?

$$\begin{array}{r}
 \begin{array}{r}
 \text{99252847} \\
 \text{64} \text{ ---} \\
 \text{216} \\
 \text{432} \\
 \text{488}
 \end{array}
 \end{array}$$

Divisor.
 Square of 4 $\times$ 3 = 48
 216 = Cube of 6.
 432 = 4 $\times$ 3 $\times$ 3 by square of 6.
 488 = Divisor $\times$ by 6.

38336 Subtrahend.
 Divisor.
 Square of 46 $\times$ 3 = 638
 27 = Cube of 3.
 1242 = 46 $\times$ 3 $\times$ 3 by square of 3.
 19044 = Divisor $\times$ by 3.

1916847 Subtrahend.

Another new and more concise method of extracting the Cube Root.

RULE. 1.—Point every third figure of the cube given, beginning at the units place, then find the highest cube to the first point, and subtract it therefrom, put the root in the quotient, bring down the figures in the next point to the remainder for a resolvend.

2. Square the quotient, and triple the square for a divisor, as $4 \times 4 \times 3 = 48$. Find how often it is contained in the resolvend, rejecting the units and tens, and put the answer in the quotient.

3. Square the last figure in the quotient, and put it on the right hand of the divisor.

As $6 \times 6 = 36$ put to the divisor $48 = 4836$.

4. Triple the last figure in the quotient, and multiply by the former, put it under the other, units under the tens, add them together, and multiply the sum by the last figure in the quotient, subtract the product from the resolvend, bring down the next point, and proceed as before.

Examples.

1. What is the cube root of 99252847?

Square of $4 \times 3 = 48$ Divisor.

Square of 6 put to 48 = 4836

$6 \times 3 \times 4 = 72$

$5556 \times 6 =$

99252847 (463
64

35252

33336

1916847

Square of 46 = 2116 $\times 3 = 6348$ Divisor.

Square of 3 = 9 put to 6348 =* 634809

$3 \times 3 \times 46 = 414$

638949 $\times 3 = 1916847$.

* NOTE.—When the quotient is two or three, there must be a cypher put to supply the place of tens.

Another Rule, still shorter.

1. Find by trials, the nearest rational cube to the given number, and call it the assumed cube.

2. Then as twice the assumed cube added to the given number, is to twice the given number added to the assumed cube, so is the root of the assumed cube to the root required nearly.

3. And by taking the cube of the root thus found, for the assumed cube, and repeating the operation, the root will be had to a still greater degree of exactness.

Examples.

1. Let it be required to find the cube root of 12484?

Here the nearest rational root is 23, and its cube 12167.

Whence 12167
2

$$\begin{array}{r} 24334 \\ 12484 \\ \hline 36818 \end{array}$$

12484
2

$$\begin{array}{r} 24068 \\ 12167 \\ \hline 37135 \end{array}$$

37135
23

$$\begin{array}{r} 111405 \\ 74270 \\ \hline \end{array}$$

36818) 854105 (23.198

11774

729

361

30

1

Answer—23.198 the root required, which is true to the last place of decimals.

2. Required the cube root of 2?

Here the nearest rational root is 1, and its cube also 1.

Whence, $1 \times 2 \div 2 = 4$, and $2 \times 2 \div 1 = 5$.

Therefore, $4 : 5 :: 1 : \frac{5}{4} = 1.25 = \text{root nearly.}$

3. What is the cube root of 34965783? *Ans.* 327
4. What is the cube root of 32461759? *Ans.* 319
5. What is the cube root of 84604519? *Ans.* 439
6. What is the cube root of 34328125? *Ans.* 325
7. What is the cube root of 22069810125? *Ans.* 2805
8. What is the cube root of 673373097125? *Ans.* 8765

NOTE.—When the given number consists of a whole number and a decimal together, make the number of decimals consist of 3, 6, 9, &c. places, by adding cyphers thereto, so that there may a point fall on the units place of the whole number.

9. What is the cube root of 12.977875? *Ans.* 2.35
10. What is the cube root of 15926.97504? *Ans.* 25.16+
11. What is the cube root of 171.46776406? *Ans.* 5.555+
12. What is the cube root of 36155.027576? *Ans.* 33.06+
13. What is the cube root of .001906624? *Ans.* .124+
14. What is the cube root of .053157376? *Ans.* .376+

To extract the Cube Root of a Vulgar Fraction.

RULE.—Reduce the fraction to its lowest terms; then extract the cube root of the numerator and denominator, for a new numerator and denominator; but should the fraction be a surd, reduce it to a decimal, and then extract the root from it.

Examples.

1. What is the cube root of $\frac{125}{343}$? *Ans.* $\frac{5}{7}$
2. What is the cube root of $\frac{352}{1188}$? *Ans.* $\frac{2}{3}$
3. What is the cube root of $\frac{64}{1000}$? *Ans.* $\frac{4}{10}$

Surds.

4. What is the cube root of $\frac{4}{27}$? *Ans.* $\frac{2}{3}$
5. What is the cube root of $\frac{1}{27}$? *Ans.* $\frac{1}{3}$
6. What is the cube root of $\frac{1}{27}$? *Ans.* $\frac{1}{3}$

To extract the Cube Root of a mixed number.

RULE.—Reduce the fractional part to its lowest terms, and then the mixed number to an improper fraction; extract the cube roots of the numerator and denominator, for a new numerator and denominator; but if the mixed number be a surd, reduce the fractional part to decimals, annex it to the whole number, and extract the root therefrom.

Examples.

- | | |
|--|----------------------------|
| 1. What is the cube root of $5\frac{104}{27}$? | <i>Ans.</i> $1\frac{4}{3}$ |
| 2. What is the cube root of $12\frac{19}{27}$? | <i>Ans.</i> $2\frac{1}{3}$ |
| 3. What is the cube root of $578\frac{19}{27}$? | <i>Ans.</i> $8\frac{1}{3}$ |

Surds.

- | | |
|---|--------------------------------|
| 4. What is the cube root of $8\frac{1}{12}$? | <i>Ans.</i> $2.013\frac{1}{2}$ |
| 5. What is the cube root of $7\frac{1}{3}$? | <i>Ans.</i> $1.966\frac{1}{2}$ |
| 6. What is the cube root of $9\frac{1}{8}$? | <i>Ans.</i> $2.09\frac{1}{2}$ |

Practical Questions, and use of the Cube Root.

1. If a cubical piece of timber be 41 inches long, 41 inches broad, and 41 inches deep; how many cubical inches doth it contain? *Ans.* 68921

2. If a cellar be dug 12 feet every way, in length, breadth, and depth; how many solid feet of earth will there be taken out of it? *Ans.* 1728

3. Suppose a piece of marble be of a cubic form to contain 474552 solid inches; what is the superficial content of one of its sides? *Ans.* 6084 inches.

To find two mean proportionals between any two given numbers.

RULE 1.—Divide the greater by the less, and extract the cube root of the quotient.

2. Multiply the root thus found, by the least of the given numbers, and the product will be the least.

3. Multiply this product by the same root and it will give the greatest.

Examples.

- | | |
|---|-------------------------|
| 4. What are the two mean proportionals between 4 and 108? | <i>Ans.</i> 12. and 36. |
| 5. What are the two mean proportionals between 6 and 750? | <i>Ans.</i> 30 and 150 |

NOTE—The solid contents of similar figures are in proportion to each other, as the cubes of their similar sides or diameters.

6. If a bullet 6 inches diameter weigh 32 lb. what will a bullet of the same metal weigh, whose diameter is 3 inches?

$$6 \propto 6 \propto 6 = 216. \quad 3 \propto 3 \propto 3 = 27.$$

As 216 : 32 :: 27 : 4 Answer.

7. If a globe of silver of 3 inches diameter, be worth £45. what is the value of another globe of a foot diameter?

$$3 \propto 3 \propto 3 = 27. \quad 12 \propto 12 \propto 12 = 1728.$$

As 27 : 45 :: 1728 : £2880 Answer.

To find the side of a cube that shall be equal in solidity to any given solid, as a Globe, Cylinder, Prism, Cone, &c.

RULE.—The cube root of the solid content of any solid body given, is the side of a cube of equal solidity.

Examples.

8. If the solid content of a globe be 10648; what is the side of a cube of equal solidity? *Ans.* 22

The side of a cube being given, to find the side of that cube which shall be double, triple, &c. in the quantity to the given cube.

RULE.—Cube the side given, and multiply it by 2, 3, &c. the cube root of the product, will be the side sought.

Examples.

9. If a cube of silver, whose side is 4 inches, be worth £50. I demand the side of a cube of the like silver, whose value shall be 4 times as much? *Ans.* 6.349 + Inches.

10. There is a cubical vessel, whose side is 2 feet; I demand the side of a vessel which shall contain 3 times as much? *Ans.* 2.884 = 2 feet 10½ inches.

Extraction of the Biquadrate Root.

RULE.—First extract the square root of the given number, and then extract the square root of that square root, and it will give the biquadrate root required.

ROOTS OF ALL POWERS.

Examples.

1. What is the biquadrate root of 20736?

$$\begin{array}{r}
 \overset{\cdot}{2}\overset{\cdot}{0}\overset{\cdot}{7}\overset{\cdot}{3}\overset{\cdot}{6}\overset{\cdot}{1}\overset{\cdot}{4}\overset{\cdot}{4} \\
 \hline
 24 \overline{)107} \\
 \underline{96} \\
 284 \overline{)1136} \\
 \underline{1136} \\
 \hline
 0
 \end{array}$$

$$\begin{array}{r}
 144 \sqrt[12]{20736} \text{ 12 Root required.} \\
 \hline
 22 \overline{)44} \\
 \underline{44} \\
 \hline
 0
 \end{array}$$

2. What is the biquadrate root of 48? *Ans.* 5308416
 3. What is the biquadrate root of 96? *Ans.* 84934656
 4. What is the biquadrate root of 5308416? *Ans.* 48
 5. What is the biquadrate root of 84934656? *Ans.* 96
 6. What is the biquadrate root of 531441? *Ans.* 27

*Roots of all Powers.**A General Rule for Extracting the Roots of all Powers.*

1. Prepare the given number for extraction, by pointing off from the unit's place, as the required root directs.
2. Find the first figure in the root by trial, or, by the table of powers, which subtract from the given number.
3. Bring down the first figure in the next point to the remainder, and call it the dividend.
4. Involve the root into the next inferior power to that which is given, multiply it by the given power, and call it the divisor.
5. Find a quotient figure by common division, and annex it to the root; then involve the whole root into the given power, and call that the subtrahend.
6. Subtract that number from as many points of the given power as are brought down, beginning at the lowest place, and

to the remainder bring down the figure of the next point for a new dividend.

7. Find a new divisor, and proceed in all respects as before.

Examples.

1. What is the square root of 141376?

141376(376 Root required.

9

6(51 Dividend.

1369 Subtrahend.

74)4476 Dividend.

141376 Subtrahend.

3 X 2 = 6 Divisor.

37 X 37 = 1369 Subtrahend.

37 X 2 = 74 Divisor.

376 X 376 = 141376 Subtrahend.

2. What is the cube root of 53157376?

53157376(376 Root required.

27

27)261 Dividend.

50653 Subtrahend.

4107)2503 Dividend.

53157376 Subtrahend.

3 X 3 X 3 = 27 Divisor.

37 X 37 X 37 = 50653 Subtrahend.

37 X 37 X 3 = 4107 Divisor.

376 X 376 X 376 = 53157376 Subtrahend.

3. If my crib is 10 feet long, 9 feet 6 inches wide, and 7 feet 8 inches deep; how many barrels of corn can I have put therein?

Ans. 115 barrels, 2 bushels $\frac{227}{800}$

4. If a person has in his garner, a bulk of wheat, which measures 8 feet 6 inches long, 6 feet 8 inches wide, and 4 feet 9 inches deep; what number of bushels has he?

Ans. 213 $\frac{1206}{2178}$ bushels.

Miscellaneous Questions.

1. What is the difference between twice five and twenty and twice twenty five?

Ans. 20.

2. To how much amounts the order, for which a merchant at the rate of $2\frac{1}{2}$ per cent per annum receives 22l. 10s.

Ans. 900l.

3. A merchant owned $\frac{3}{4}$ of a ship, sold $\frac{2}{3}$ of his share for 1260l. what was the value of the whole at the same rate?

Ans. 5040l.

4. Bought a quantity of merchandize for 250l. and 3 months after sold it for 275l. how much per cent per annum was gained by them?

Ans. 40l.

5. How many pounds sterling will answer a bill of exchange of 516l. 16s. 8d. Virginia currency, the exchange at $37\frac{1}{2}$ per cent?

Ans. 375l. 17s. 7d.

6. What will 315l. 16s. 8d. amount to in 4 years and 7 months, at 5 per cent per annum simple interest?

Ans. 388l. 4s. $2\frac{1}{2}$ d.

7. In selling a yard of cloth worth 15s. $2\frac{1}{2}$ d. I lost $27\frac{1}{2}$ per cent, and a fallen market obliges me to sell the same cloth at 13s. 6d. per yard; what did I lose per cent by the last sale?

Ans. 30l. 19s. 7d. +

8. A person left an only daughter 2500l. to be paid her two years after his decease; the young lady marrying 6 months after her father's decease, demands her fortune, which the executors agreed to pay at a discount of 5 per cent per annum; what did she receive?

Ans. 2325l. 11s. $7\frac{1}{2}$ d. +

9. How much plank will lay a floor that is $16\frac{1}{2}$ feet square, and how many squares will the floor contain?

Ans. $\left\{ \begin{array}{l} 272 \text{ feet, } 3 \text{ inches.} \\ 2 \text{ squares, } 72 \text{ feet, } 3 \text{ inches.} \end{array} \right.$

10. A table whose superficial contents is 72 feet and the breadth 3 feet; what is the length of the table?

Ans. 24 feet.

11. If the contents of a superficial foot be 144 inches and a plank be 9 inches broad; how much in length will make a foot square?

Ans. 16 inches.

12. There is 136*l.* to be divided between two men, so that the lesser sharer may have such proportion to the greater as 2. to 5. what must each man have?

Ans. $\left\{ \begin{array}{l} 38\textit{l. } 17\textit{s. } 1\frac{1}{2}\textit{d. } \frac{5}{7} \text{ the lesser.} \\ 97\textit{l. } 2\textit{s. } 10\frac{1}{2}\textit{d. } \frac{1}{7} \text{ the greater.} \end{array} \right.$

13. What is the third and half the third of 10*d.*?

Ans. 5*d.*

14. In a box of glass containing 175 feet, 12 by 10 inches; how many panes?

Ans. 210.

15. By an act of congress there was a portion of land, laid off 10 miles square, for the Federal City (Washington); how many acres doth the square contain?

Ans. 6400.

16. What is the insurance of a cargo from Richmond to Philadelphia, valued at 75360 dollars at $4\frac{1}{2}$ per cent?

Ans. 3579 doll. 60 cts.

17. Three men are to share 100*l.* A. is to have a certain sum. B. twice as much; and C. three times as much; how much should each have?

Ans. $\left\{ \begin{array}{l} A \ 11\textit{l. } 2\textit{s. } 2\frac{1}{2}\textit{d. } \frac{5}{8} \\ B \ 22\textit{l. } 4\textit{s. } 5\frac{1}{2}\textit{d. } \frac{3}{8} \\ C \ 66\textit{l. } 13\textit{s. } 4\textit{d.} \end{array} \right.$

18. In what time will 750 dollars amount to 1000 dollars at 6 per cent per annum simple interest?

Ans. 5 $\frac{1}{3}$ years.

19. A person lent 90*l.* for 12 months, and received for principal and interest 95*l.* 8*s.* at what rate per cent did he receive interest?

Ans. 6 per cent.

20. A. and B. traded together, and gained 100 dollars. A. put in 640 dollars. B. put in such a sum as to entitle him to receive 60 dollars of the gain; what sum did B. put in?

Ans. 960 dollars.

21. How much ready money should I advance for B's note of 60 dollars, payable at 15 months; if I am allowed 6 per cent discount?

Ans. 55 doll. 81 cts. +

22. B. hath linen worth 62 $\frac{1}{2}$ cents ready money, but in trade he will have 75 cents. C. hath cloth worth 3 dollars 50 cents ready money, at what ought C. to rate his cloth to make his profit equal to B's?

Ans. 4 doll. 20 cents.

23. In what time will a sum of money double itself at 6 per cent per annum, simple interest?

Ans. 16 years, 8 months.

24. A young man received 210*l.* which was $\frac{2}{3}$ of his brother's portion: now three times the elder brother's portion, was half their father's estate; I demand how much the estate was?

Ans. 1890*l.*

25. Two men had 40 dollars to be divided between them, in the following manner, viz: As oft as the first man A. had 45 cents, the other, B. had 40 cents; divide the money among them?

Ans { A 21 dollars $\frac{15}{85}$
B 18 $\frac{70}{85}$

26. If a merchant buys 1000 Ells Flemish of linen for 300 dollars; what may he sell it per yard to gain 30 dollars by the whole?

Ans. 44 cents.

27. When 15 more than the $\frac{1}{2}$ of the members of an assembly were met, there were 10 more than a third absent; how many did that branch of the legislature consist of?

Ans. 150.

28. A guardian paid his ward 3500*l.* for 2500*l.* which he had in his hands 8 years; what rate of interest did he allow him?

Ans. 5 per cent.

29. A merchant hired a clerk for 50*l.* per annum, payable quarterly, has (agreeably to a subsequent contract), retained the young man's salary in trade for 11 years and an half, on conditions of allowing him 6 per cent compound interest, on the several payments, as they become due; how much should he receive?

Ans. 813*l.* 1*s.*

30. What difference is there between six dozen dozen and half a dozen dozen?

Ans. 792.



